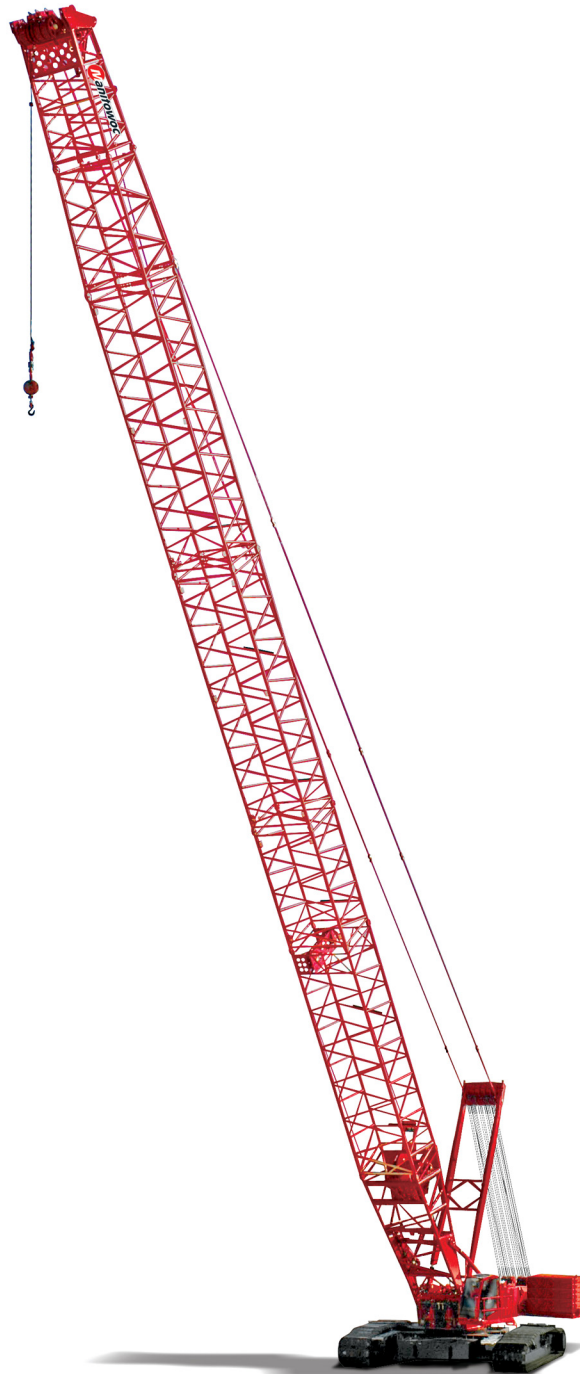


# Manitowoc 16000

## Operator Manual







# OPERATOR MANUAL

This manual has been prepared for and is considered part of -

**16000**

Crane Model Number

**16001Ref**

Crane Serial Number

This Manual is divided into the following sections:


<b>SECTION 1</b>	<b>INTRODUCTION</b>
<b>SECTION 2</b>	<b>SAFETY INFORMATION</b>
<b>SECTION 3</b>	<b>OPERATING CONTROLS AND PROCEDURES</b>
<b>SECTION 4</b>	<b>SET-UP AND INSTALLATION</b>
<b>SECTION 5</b>	<b>LUBRICATION</b>
<b>SECTION 6</b>	<b>MAINTENANCE CHECKLIST</b>

## NOTICE

The serial number of the crane and applicable attachments (i.e. luffing jib, MAX-ER®) is the only method your Manitowoc dealer or Manitowoc Crane Care has of providing you with correct parts and service information.

The serial number is located on a crane identification plate attached to the operator's cab and each attachment. Refer to the Nameplate and Decal Assembly Drawing in Section 2 of this manual for the exact location of the crane identification plate.

**Always furnish serial number of crane and its attachments** when ordering parts or discussing service problems with your Manitowoc dealer or Manitowoc Crane Care.

	<b>⚠ WARNING</b>
	<p><b>To prevent death or serious injury:</b></p> <ul style="list-style-type: none"><li>• Avoid unsafe operation and maintenance. Crane and attachments must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.</li><li>• Do not operate or work on crane or attachments without first reading and understanding instructions contained in Operator Information Manual and Service Manual supplied with crane and applicable attachments.</li><li>• Store Operator Information Manual and Service Manual in operator's cab.</li></ul> <p>If Operator Information Manual or Service Manual is missing from cab, contact your Manitowoc dealer for a new one.</p>

***THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH***

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## SECTION 1 INTRODUCTION

### CRANE DATA

See the end of this section for crane information specific to your crane:

- Basic Specifications
- EC Declaration (if applicable)

### CRANE/ATTACHMENT IDENTIFICATION

An identification plate is attached to the outside of the operator's cab ([Figure 1-1](#)) and to the attachments (for example, luffing jibs and MAX-ERs).

The crane or attachment model and serial number are provided on the plate.

For the exact location of the identification labels on your crane and attachments, refer to the Nameplates and Decals drawing in Section 2.

### CHANGE OF OWNERSHIP REGISTRATION

If you are the new owner of a Manitowoc crane, please register it with Manitowoc Crane Care so we can contact you if the need arises.

1. Go to [www.manitowoccranes.com](http://www.manitowoccranes.com)
2. Go to Service > Manitowoc Crane Care > Service Information > Change of Ownership Form.
3. Complete the form.

### MANITOWOC DEALER

For questions about this manual or the 16000 crane, contact your Manitowoc dealer. If you do not know the contact information for your dealer, locate the Manitowoc dealer nearest you, as follows:

1. Go to [www.manitowoccranes.com](http://www.manitowoccranes.com)
2. Go to Dealer Locator.
3. Follow the on-screen prompts to locate your Manitowoc dealer.

### CRANE ORIENTATION

The terms right, left, front, and rear used in this manual refer to operator's right, left, front, and rear sides when seated in the operator's cab looking forward.

- The boom is on the front of the rotating bed.
- The carbody and crawler controls are on the front of the carbody.

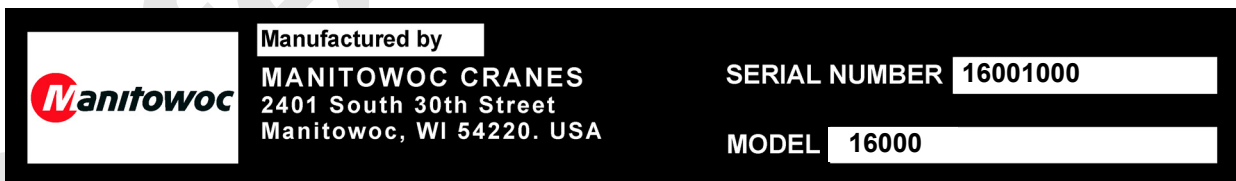
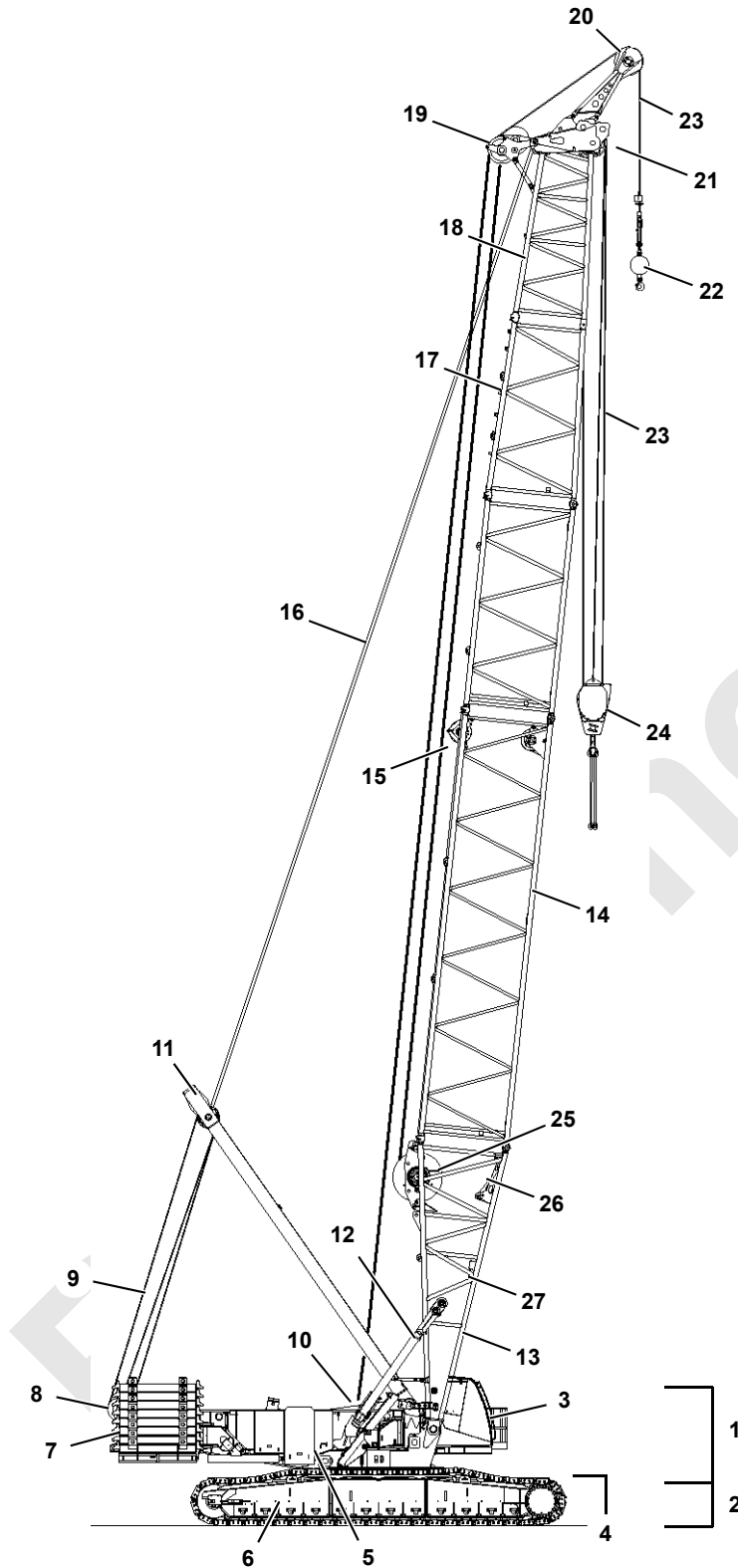


FIGURE 1-1

IDENTIFICATION AND LOCATION OF COMPONENTS



Item	Description
1	Upperworks
2	Undercarriage
3	Operator's Cab
4	Carbody Counterweight (both ends)
5	Enclosures (both sides)
6	Crawler
7	Crane Counterweight
8	Boom Hoist Sheaves
9	Boom Hoist Wire Rope
10	Mast Arms with Cylinders
11	Mast (Live)
12	Telescopic Boom Stop
13	Boom Butt
14	Boom Insert
15	Wire Rope Guides (in Insert)
16	Boom Straps
17	Transition Insert
18	Boom Top
19	Wire Rope Guide
20	Upper Boom Point
21	Lower Boom Point
22	Weight Ball
23	Load Lines
24	Load Block
25	Main Hoist
26	Auxiliary or Luffing Hoist
27	Rigging Winch
28	Swing Drive
29	Carbody Counterweights (both ends)
30	Platform with Step
31	Crawler Drive
32	Carbody
33	Adapter Frame (Rotating Bed)
34	Rotating Bed Jack (both sides front) (Not furnished with European option)
35	Rotating Bed
36	Rotating Bed Jack (both sides rear) (Not furnished with European option)
37	Boom Hoist (standard) OR Mast Hoist (MAXer)
38	Fuel Tank
39	Radiator
40	Power Plant (with Pump Drive)
41	Hydraulic Tank
42	Whip Hoist
43	Carbody Jacks (European option)

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FIGURE 1-2

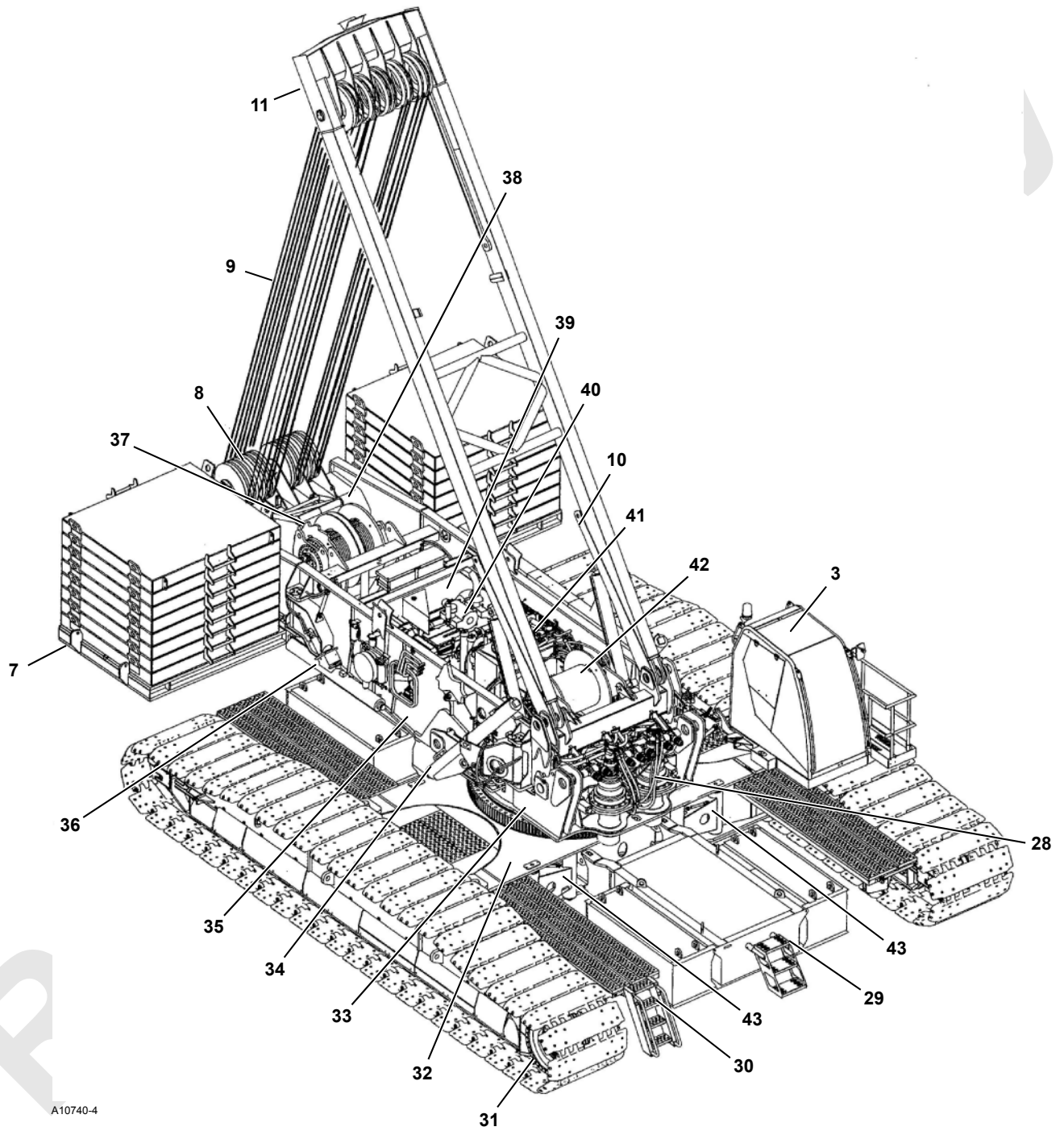
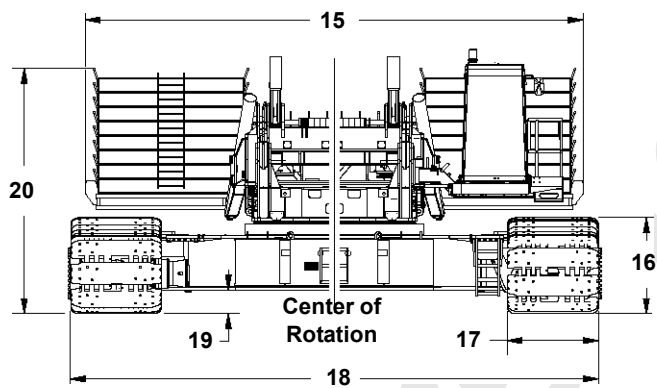


FIGURE 1-2 continued







Item	Dimension
1	14,20 m (46 ft 4 in)
2	9,88 m (32 ft 5 in)
3	11,60 m (38 ft 1 in)
4	7,90 m (25 ft 11 in)
5	4,43 m (14 ft 6 in) Top of Light on Cab
6	2,68 m (8 ft 9 in)
7	1,52 m (5 ft 0 in)
8a	10,43 m (34 ft 3 in)
8b	11,22 m (36 ft 9 in)
9	5,22 m (17 ft 1 in)
10	7,56 m (24 ft 6 in)
11	11,13 m (36 ft 6 in)
12	10,00 m (32 ft 8 in) Mast Tail Swing OR 8,20 m (27 ft 0 in) Counterweight Tail Swing
13	1,75 m (5 ft 8 in)
14	3,58 m (11 ft 8 in)
15	8,33 m (27 ft 4 in)
16	1,61 m (5 ft 3 in)
17	1,52 m (5 ft 0 in)
18	8,84 m (29 ft 0 in)
19	0,39 m (1 ft 3 in)
20	4,11 m (13 ft 6 in) Series 3 3,88 m (12 ft 9 in) Series 2 3,40 m (11 ft 2 in) Series 1

## ENGLISH AND METRIC CONVERSIONS

### Direct Conversion

Multiply (x) known value by conversion factor to obtain equivalent value in desired units. For example, 12 ft is converted to meters (m), as follows:

$$12 \text{ ft} \times 0.3048 = 3,6576 \text{ m}$$

### Inverse Conversion

Divide (÷) known value by conversion factor to obtain equivalent value in desired units. For example, 3.6576 m is converted to feet, as follows:

$$3,6576 \text{ m} \div 0.3048 = 12$$

To Convert	Symbol	Application	To	Symbol	Multiply By
<b>AREA</b>					
Square Inch	in <sup>2</sup>	Filter Area Clutch Contact	Square Centimeter	cm <sup>2</sup>	6.4516
Square Foot	ft <sup>2</sup>	Ground Contact	Square Meter	m <sup>2</sup>	0.0929
<b>FORCE</b>					
Pound Force	lb	Pedal Effort	KiloNewton Newton	kN N	0.00445 4.4482
Pound Force	lb	Line Pull	KiloNewton	kN	0.00445
Pound Force Per Inch	lb/in.	Spring Force	Newton per millimeter	Nmm	0.1751
Pound Force Per Foot	lb/ft		Newton per meter	Nm	14.5939
<b>LENGTH</b>					
Inch	in.	Adjustments	Millimeter	mm	25.4000
Foot	ft	Outline Dimensions	Meter	m	0.3048
Mile	miles	Travel Distance	Kilometer	km	1.6093
<b>POWER</b>					
Horsepower	hp	Engine	Kilowatt	kW	0.7457
<b>PRESSURE</b>					
Pound/Sq. In.	psi	Hydraulic & Air	Bar		0.0689
<b>TEMPERATURE</b>					
Degrees Fahrenheit	°F	Oil, Air, Etc.	Degrees Centigrade	°C	°F - 32 ÷ 1.8
Degrees Centigrade	°C		Degrees Fahrenheit	°F	°C x 1.8 + 32
<b>TORQUE</b>					
Inch Pound	in lb	Bolt Torque	Newton Meter	Nm	0.1129
Foot Pound	ft lb		Newton Meter	Nm	1.3558
<b>VELOCITY</b>					
Miles Per Hour	mph	Vehicle Speed	Kilometers Per Hour	km/h	1.6093
Miles Per Hour	mph	Wind Speed	Meters Per Second	m/s	0.4470
Feet Per Minute	fpm	Line Speed	Meters Per Minute	m/min	0.3048
<b>VOLUME</b>					
Cubic Yard	yd <sup>3</sup>	Bucket Capacity	Cubic Meter	m <sup>3</sup>	0.7646
Cubic Foot	ft <sup>3</sup>		Cubic Meter	m <sup>3</sup>	0.0283
Cubic Inch	in <sup>3</sup>	Pump Displacement	Cubic Centimeter	cm <sup>3</sup>	16.3871

To Convert	Symbol	Application	To	Symbol	Multiply By
<b>VOLUME (LIQUID)</b>					
Ounce	oz	Fluid Capacities	Milliliter	mL	29.5735
Pint	pt		Liter	L	0.4732
Quart	qt		Liter	L	0.9464
Gallon	gal		Liter	L	3.7854
Gallon Per Minute	gpm	Pump Flow	Liters Per Minute	L/min	3.7854
<b>WEIGHT</b>					
Pound	lb	Unit/Component	Kilogram	kg	0.4536
Ton (2,000 lb.)	USt	Load Ratings	Metric Ton	t	0.9072
Ton (2,000 lb.)	USt		Kilogram	kg	907.1847

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## SECTION 2

### SAFETY INFORMATION



#### WARNING

##### California Proposition 65

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to [www.P65warnings.ca.gov/diesel](http://www.P65warnings.ca.gov/diesel).

Battery posts, terminals, and related accessories contain chemical lead and lead compounds, chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

##### California Spark Arrestor

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The owner/operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

### CONTINUOUS INNOVATION

Due to continuing product innovation, the information in this manual is subject to change without notice. If you are in doubt about any procedure, contact your Manitowoc dealer or the Manitowoc Crane Care Lattice Team.

### Nameplates and Decals

See drawing at the end of this section.

### SAFETY MESSAGES

#### General

The importance of safe operation and maintenance cannot be over emphasized. Carelessness or neglect on the part of operators, job supervisors and planners, rigging personnel, and job site workers can result in their death or injury and costly damage to the crane and property.

To alert personnel to hazardous operating practices and maintenance procedures, safety messages are used throughout the manual. Each safety message contains a safety alert symbol and a signal word to identify the hazard's degree of seriousness.

### Safety Alert Symbol



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. **Obey all safety messages that follow this symbol to avoid possible death or injury.**

### Signal Words



#### DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



#### WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



#### CAUTION

Used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### CAUTION

Without the safety alert symbol, identifies potential hazards that could result in property damage.

**NOTE:** Highlights operation or maintenance procedures.

### Symbol Identification

Many of the symbols used in the safety and information signs and nameplates on this crane are identified in [Table 2-1](#) and [Table 2-2](#).

Table 2-1 Common Safety Symbols





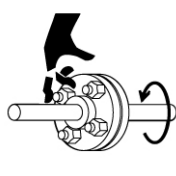


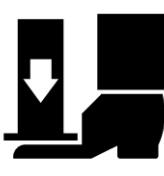












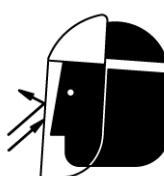

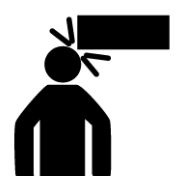


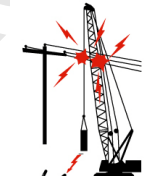


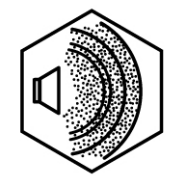









<b>Cut or Crush Hazards</b>					<b>Cut Hazard</b>
 M100090	 M100091	 M100066	 M100065	 M100069	 M100067
<b>Crush Hazards</b>					<b>Fire Extinguisher</b>
 M100070	 M100071	 M100072	 M100073	 M100074	 M100082
<b>Fall Hazards</b>			<b>Falling Boom (Crush) Hazards</b>		<b>Explosion Hazard</b>
 M100083	 M100084	 M100085	 M100068	 M100075	 M100080
<b>Falling Load Hazards</b>		<b>Flying Objects Hazards</b>		<b>Overhead Obstruction Hazard</b>	<b>Pressure Release Hazard</b>
 M100076	 M100077	 M100088	 M100088	 M100089	 M100081
<b>Electrocution Hazards</b>		<b>Personal Fall Protection</b>	<b>Pressure Cleaning</b>	<b>Sound Power Level</b>	<b>Read Manual</b>
 M100078	 M100079	 M100095	 M100087	 M100096	 M100093



Table 2-2 Miscellaneous Symbols

Diesel Fuel	Engine Coolant	Engine Coolant Vent	Engine Oil Level
 M100271	 M100267	 M100268	 M100269
Pump Drive Oil Level	Tire Pressure (if equipped)	Hydraulic Filter	Hydraulic Oil
 M100270	 M100266	 M100272	 M100273

**SAFETY AND INFORMATION SIGNS**

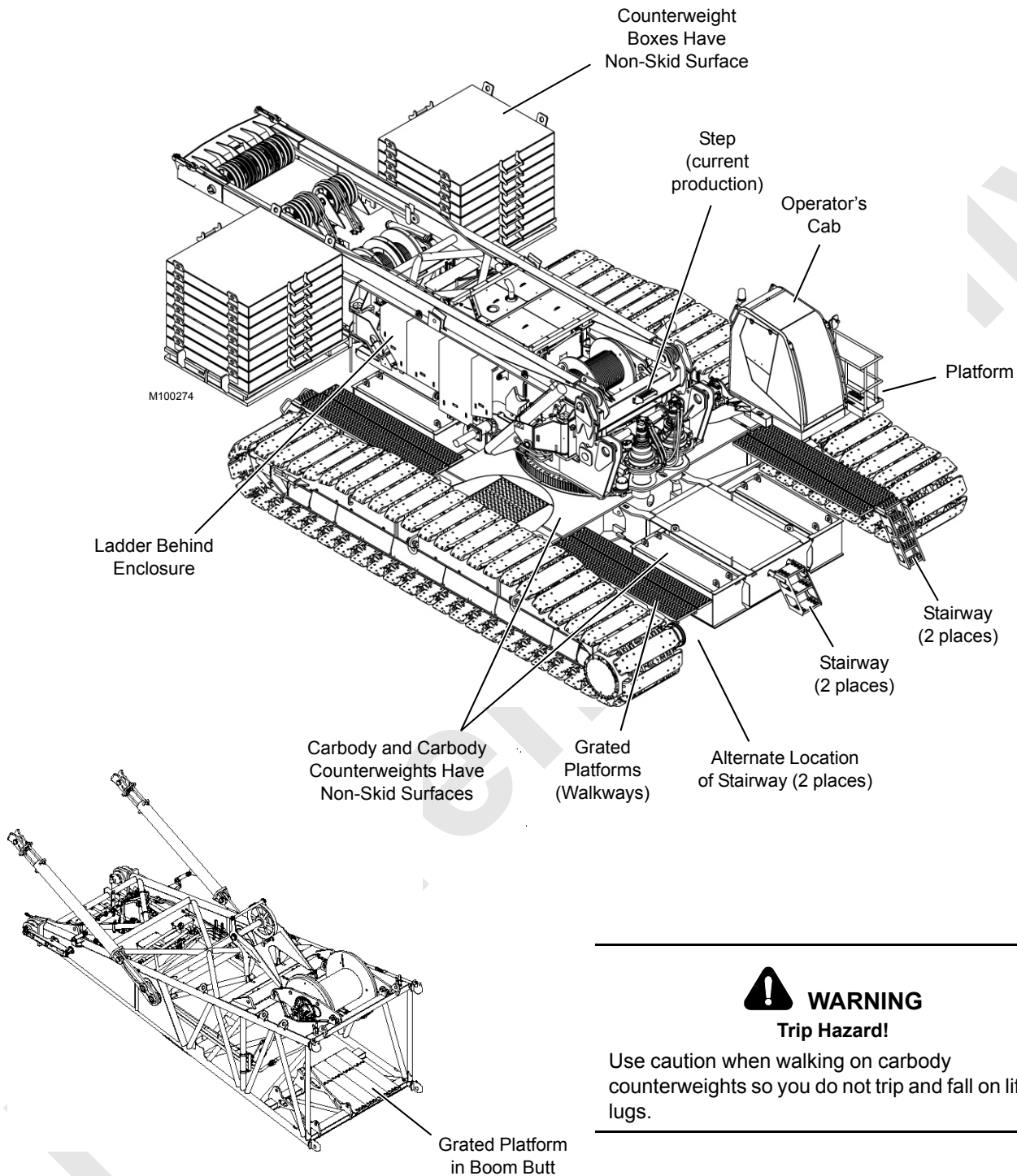
**Maintaining Signs**

The crane owner/user shall make sure that all safety and information signs are legible and installed at the proper locations on the crane. If a sign has been defaced or removed, it must be replaced immediately. See the Nameplate and Decal Drawing at the end of this section for the installation locations of signs.

**Ordering Signs**

Order replacement safety and information signs from your Manitowoc dealer.

When ordering a sign, give the crane model number, the crane serial number, and the name and part number of the sign.



**WARNING**

**Trip Hazard!**

Use caution when walking on carbody counterweights so you do not trip and fall on lifting lugs.

FIGURE 2-1

## CRANE ACCESS POINTS



### WARNING

#### Crush Hazard!

Upperworks can swing into and crush personnel climbing on or off crane.

Moving crawlers can crush personnel climbing on or off crane.

To prevent death or serious injury:

- Barricade all accessible areas to crane so personnel cannot be struck or crushed when upperworks is swung. See Swing Radius Barrier topic in this section.
- Do not climb onto or off crane while upperworks is being swung or crane is being traveled.
- Signal operator for permission to climb onto/off crane.
- Operator: do not swing or travel while personnel are climbing onto or off crane. Stop swing and travel motions. Apply swing brake and turn on travel park.
- Operator: Always sound horn to alert personnel before you swing or travel.
- Automatic alarms will sound to alert personnel when the crane is swung or traveled.

**NOTE:** If the swing and travel alarms are not operating properly, they must be repaired as soon as possible. Until they are repaired, the operator must alert personnel to crane movement using the horn on the control console.

## General

Take the necessary precaution to prevent slipping and/or falling off the crane during assembly, disassembly, maintenance, or other work. **Falling from any height could result in serious injury or death.**

Manitowoc has provided stairways, ladders, and platforms at the locations shown in [Figure 2-1](#).

The owner/user must provide workers with approved ladders or aerial work platforms to access those areas of the crane, mast, and boom that cannot be reached from the ground or from steps, ladders, catwalks, and platforms provided by Manitowoc.

Adhere to local, state, and federal regulations for handling personnel and for personnel fall protection.

- Access points must be kept clear to prevent personal injury and unsafe operation of crane. Store clothing and

other personal belongings so they do not interfere with controls in the operator cab or with crane operation.

- Do not allow ground personnel to store their personal belongings (clothing, lunch boxes, water coolers, and the like) on the crane.

This practice will prevent ground personnel from being crushed or electrocuted when they attempt to access personal belongings stored on the crane.

- Tools, oil cans, spare parts, and other necessary equipment must be stored in tool boxes or other appropriate locations. Do not allow these items to lie around loose in the operator cab or on steps, ladders, catwalks, and platforms.
- To reduce risk of slipping, non-skid material (sand in paint) has been applied to painted walkways and platforms.

Walkways and platforms can be slippery when wet and when oil or is grease is spilled on them. **Keep walkways and platforms clean and dry to prevent slipping on them.** When non-skid material wears out, reapply it.

- Wear shoes with a highly slip-resistant sole material. Clean any mud or debris from shoes before entering the crane cab or climbing onto the cab. A shoe that is not clean might slip off a control pedal during operation.
- Do not make modifications or additions to the crane's access system that have not been evaluated and approved by Manitowoc.
- Do not use top of mast, boom, or jib as walkways unless they have catwalks.

**NOTE:** Catwalks are available from Manitowoc for boom and jib sections.

Two optional ladders, stored in 40 ft (12 m) insert next to the boom butt, are available for boom assembly and disassembly. See Boom Ladder Assembly in Section 4 for instructions.

## GETTING ON OR OFF CRANE

Personnel getting on and off crane shall do so only at steps or ladders provided and only **while crane is parked**.

Never climb onto or off a moving crane. **Climb onto and off crane only when it is parked and only with operator's permission.**

When personnel use ladders to get on or off the crane, their hands shall be free of any objects. Objects which cannot be carried in pockets or tool belts must be lifted into place with a hand line or hoist.

## OPERATOR MANUAL/CAPACITY CHART STORAGE

Manitowoc provides the following manuals and other important literature with your crane and attachment (Luffing Jib, etc.):

- Operator Manual (Serial Numbered)  
Contains safety information, crane specifications, assembly/erection procedures, operating instructions, lubrication and maintenance checks.
- Parts Manual (Serial Numbered)  
Contains illustrations and part numbers of replaceable parts.
- Capacity Chart Manual (Serial Numbered)  
Contains lifting capacities and related information (wire rope specifications, drum and lagging information, etc.)
- Maintenance Checks and Lube Guide  
Contains lists of maintenance checks and lube services and their prescribed intervals.
- RCI/RCL Operation  
Contains rated capacity indicator and/or rated capacity limiter operation, limits, and calibration procedures.
- Service Manual (Serial Numbered)  
Contains theory of operation, maintenance procedures, crane and wire rope inspection procedures, troubleshooting information, and shop procedures.

The manuals which must be retained in the operator's cab (Operator Manual, Capacity Charts, Maintenance Checks and Lube Guide, and RCL Operation) are supplied in a OPERATOR INFORMATION binder. A separate binder is provided for the crane and each applicable attachment.

The Operator Manuals and Capacity Charts are stamped with the serial number of the crane or attachment. The serial number on the manuals and capacity charts must match the serial number of the crane and attachment in use. **Using any other manual or capacity chart is prohibited.**

- The crane model and serial number is located on the Crane Identification Plate on the crane cab.
- The model and serial number of the attachment (other than standard boom) is located on the Crane Identification Plate on the attachment.

If the serial numbers of your manuals and capacity charts do not match the serial numbers of the crane or attachment, contact your Manitowoc dealer for the proper manual or capacity charts.

**Do not operate crane or attachment if proper Capacity Chart is not in cab.**

## Storing Manuals

Store the Operator Information Manuals for the crane and each applicable attachment on the bookshelf in the operator's cab ([Figure 2-2](#)).

Attach the chain from the manual in use to the link behind the operator's seat.

Keep all other manuals provided with the crane in the crane owner/user's office so they are readily available when needed.

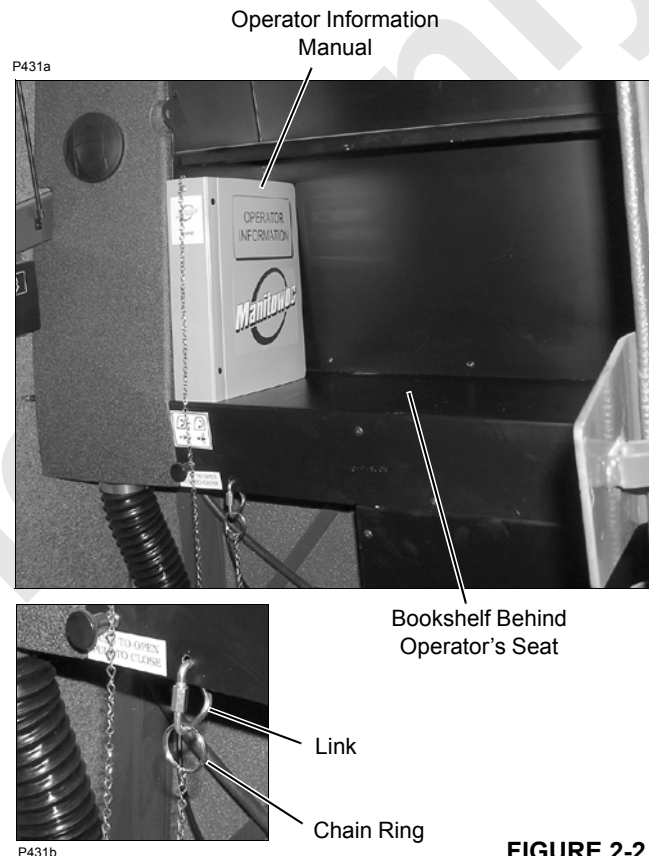


FIGURE 2-2

## SWING RADIUS BARRIER

Manitowoc's optional swing radius barrier is shown in [Figure 2-3](#).

**! WARNING**  
**Crush Hazard!**

To prevent personnel from being crushed by swinging crane, deploy swing radius barrier before operating crane.

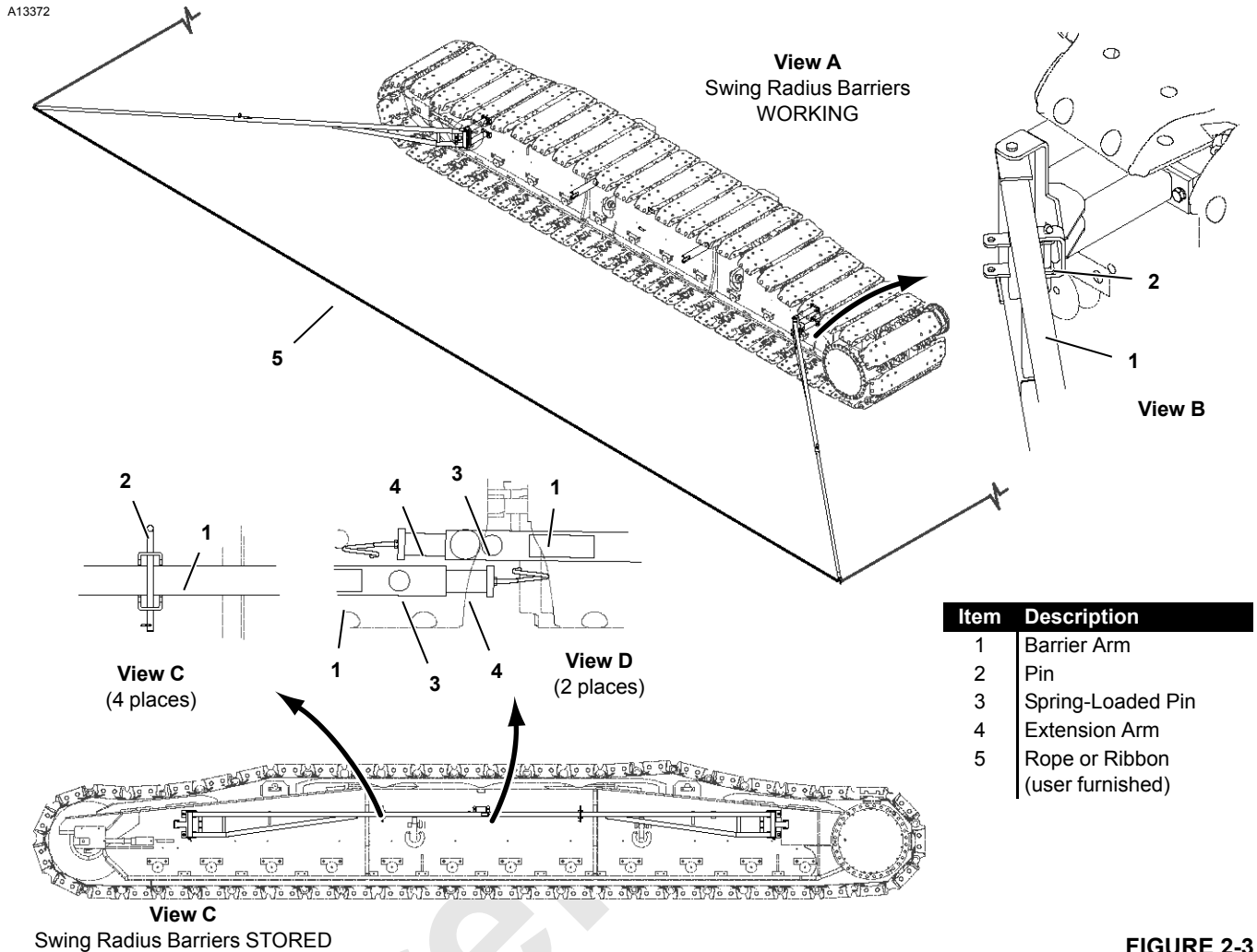


FIGURE 2-3

### Deploying Swing Radius Barrier

1. Remove pins (2, View C) from shipping position.
2. Rotate barrier arms (1) outward to working position (View A).
3. Install pins (2, View B) in working position.
4. Pull on spring-loaded pins (3, View D), pull extension arms (4) out part way, and release pins.
5. Pull extension arms (4) out fully until they are locked in position by spring-loaded pins (5) as shown in View A.
6. Form a safety perimeter by attaching user supplied high visibility rope or ribbon to hooked ends of extension arms.

### Storing Swing Radius Barrier

1. Remove rope or ribbon from hooked ends of extension arms (4).
2. Pull on spring-loaded pins (3, View D), push extension arms (4) in part way, and release pins.
3. Push extension arms (4) in fully until they are locked in position by spring-load pins (5).
4. Remove pins (2, View B) from working position.
5. Rotate barrier arms (1) inward and install pins (2, View C) in shipping position.

## SAFE OPERATING PRACTICES

### General

The importance of safe operation cannot be over emphasized. Carelessness and neglect on the part of operators, supervisors and planners, rigging personnel and job site personnel can result in their death or injury and costly damage to the crane or property.

The safety information in this publication is intended only as a guide to assist qualified operators, supervisors and planners, rigging personnel, and job site personnel in safe operation. Manitowoc cannot foresee all hazards that will arise in the field. Therefore, **safety remains responsibility of crane operators and owner.**

Local, state, and other governmental agencies may require stricter operating practices. When a conflict in practices exists, follow the strictest practice.

### Read Operator Manual

Safe and efficient assembly, disassembly, and operation of this crane requires that it be maintained in proper working order and that its operators and maintenance personnel be familiar with the crane's functions and capabilities.

The Operator Manual supplied with and considered part of your crane must be read and completely understood by each person responsible for assembly, disassembly, operation, and maintenance of the crane.

The Operator Manual must be read to personnel who cannot read or understand English or other language into which the manual is translated.

Because of a program of continuing improvement in product design, Manitowoc reserves the right to change the information and specifications contained in the Operator Manual at any time without notice. If you have any questions regarding the crane or its Operator Manual, please contact your Manitowoc dealer.

### Operator Qualifications

The crane must be operated only by the following **qualified** personnel:

- Designated operators
- Trainees under direct supervision of a designated operator
- Supervisors, inspectors, and maintenance or test personnel when necessary in performance of their duties. Operation of the crane by these personnel shall be limited to the crane functions needed to perform the inspection or to verify the crane's performance after maintenance procedures.

***No personnel shall be allowed to climb onto crane or enter crane cab unless performance of their duties requires them to do so, and then only with knowledge of operator or other qualified person.***

**Qualified person** is defined as one who by reason of training and experience is thoroughly familiar with crane operations and the hazards involved. Such a person shall meet the operator qualifications specified in Occupational Safety and Health Administration (OSHA) Regulations (United States Federal Law), in ASME B30.5 American National Standard, or in any other applicable federal, state, or local laws.

**Operator training and qualification is crane owner's responsibility.**

**NOTE:** The regulations and standards mentioned above and later in this section can be obtained from:

**US DOL/OSHA** Rules and Regulations are available by mail from the Superintendent of Documents, PO Box 371954, Pittsburgh, PA, 15250-7954 or by:

- Phone 202-512-1899
- Fax 202-512-2250
- Online at [www.osha.gov](http://www.osha.gov)

**ASME** (formerly ANSI) B30 Series American National Standards are available by mail from the ASME, 22 Law Drive, Fairfield, New Jersey, 07004-2900 or by:

- Phone US & Canada 800-843-2763
- Phone Mexico 95-800-843-2763
- Phone Universal 973-882-1167
- Fax 973-882-1717 or 973-882-5155
- E-mail [infocentral@asme.org](mailto:infocentral@asme.org)

### Operator Conduct

1. The operator shall not engage in any practice which diverts his/her attention while operating the crane.
2. The operator shall not operate the crane when he/she is physically or mentally unfit.
3. The operator shall be responsible for all operations under his/her direct control. When safety of an operation is in doubt, the operator shall stop the crane's functions in a controlled manner. Lift operations must resume only after safety concerns have been addressed or the continuation of crane operations is directed by the lift supervisor.
4. The operator shall be thoroughly familiar with operation of crane and its proper care. If adjustments or repairs are necessary or if there are known defects that impair safe

operation, the crane shall not be operated until unsafe conditions have been corrected.

5. If there is a warning sign at the start controls, the operator shall not start the engine until the warning sign has been removed by the person who installed it.
6. Before starting the engine, the operator shall make sure that:
  - a. All daily inspection and maintenance services have been performed.
  - b. All controls are in off the position and all brakes and locking devices are applied or engaged.
  - c. All personnel are clear of the crane. Deploy a swing radius barrier.



### WARNING

Safety devices and operational aids such as rated capacity indicator or limiter, boom and jib angle indicator or limiter, anti-two-block device, level indicator, swing limiter, proximity device, etc., may be installed on your crane. Such devices are to be used only as **AIDS TO ASSIST OPERATOR**. Their presence on crane in no way substitutes for or lessens requirement that operator knowledge, experience, and judgment are required to ensure safe operation of crane.

**Crane must not be loaded beyond applicable static or dynamic ratings given in Capacity Chart for crane.**

- See Size of Load topic later in this section
- For a description of each safety device and operational aid, see [Safety Devices](#) and [Operational Aids](#) in this section and Section 3 of this manual

7. The operator shall test all controls, limits, and communication systems at the start of each shift. Any defects found must be corrected before operation is begun.
8. The operator shall not start crane movement if the load or designated signal person is not within his/her range of vision or communication.
9. The operator shall understand and respond to signals from the person directing the lift or from the designated signal person. When a signal person or crane follower is not required, the operator is responsible for the lift. **Operator shall obey a stop signal at all times, no matter who gives it.**
10. The operator shall verify that the Capacity Chart being used is the correct one for the cranes configuration (boom length, load line reeving, counterweight, etc.).
11. The operator shall verify that:

- a. All attachments are properly assembled and attached to the crane according to the rigging drawings called for in the Capacity Chart.
- b. The counterweight — to include applicable auxiliary counterweight — is in place and of proper weight. **Maximum required counterweight shall not be exceeded.**



### WARNING

#### Moving Load/Tipping Crane Hazard!

Changing weather conditions including but not limited to: wind, ice or snow accumulation, precipitation, flooding, lightning, etc. should be considered when determining the location and configuration of a crane when it will be left unattended.

- c. The operator shall perform the following operations before leaving the operator's cab for any reason:
  - d. Park crane and position upperworks so crane does not interfere with operation of other equipment.
  - e. Apply travel and swing brakes or locking devices.
  - f. Land any attached load.
  - g. Lower the boom onto blocking at ground level or onto a boom rest if possible.

If the boom cannot be lowered, as determined by a qualified designated person, it must be securely fastened from movement by wind or other outside forces (see Wind Conditions in Capacity Chart Manual).

**NOTE:** The designated person must be familiar with the job site limitations, the crane configuration, and the expected weather conditions.

- h. Move all controls to off.
- i. Apply all drum brakes and pawls.
- j. Disengage the master clutch, if equipped.
- k. Stop the engine.

**NOTE:** Also read Unattended Crane instructions in Section 3 of the 16000 Operator Manual.

12. The operator shall perform the following operations if power or a control function fails during operation:
  - a. Land all suspended loads, if possible, under brake or power control.
  - b. Apply all brakes and locking devices.
  - c. Move all controls to off.

13. If the crane will be operated at night, the operator shall make sure that there is sufficient lighting for safe operation. The load and landing area shall be illuminated.

14. The operator shall not operate the crane during periods of bad weather if his/her ability to see the load or the signal person is impaired by darkness, fog, rain, snow, and the like.

Do not operate the crane with a snow or ice covered boom. The extra weight may cause overload, tipping, or structural damage.

Never operate the crane during an electrical thunderstorm.

When a local weather storm warning exists (including electrical thunderstorm), stop operation and secure the crane. See step c under Operator Conduct topic.

**NOTE:** DO NOT depend on grounding. Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the conductor (wire) used, condition of the ground, the magnitude of voltage and current present, and numerous other factors.

15. Wind can cause the crane to tip or the boom and other attachments to collapse. The operator or qualified person directing the lift shall compensate for the effect of wind on the load and boom by reducing ratings, reducing operating speeds, or a combination of both.

Unless otherwise specified in the Capacity Chart, or in Operator Manual, stop operation under the following wind conditions:

- a. If the wind causes the load to swing forward past the allowable operating radius or sideways past either boom hinge pin, land the load and apply the drum brakes.
- b. If the wind exceeds 35 mph, land all loads and apply the drum brakes, lower the boom onto blocking at ground level or otherwise restrain it, and apply the swing and travel brakes and/or locks.

**NOTE:** *“Land load”* means to set it down on a firm uniformly supporting surface.

16. Booms, jibs, or masts which are being assembled or disassembled on the ground (with or without support of boom rigging) must be securely blocked to prevent the boom, jib, or mast sections from dropping.

**Workers shall not go under boom, jib, or mast sections when removing connecting pins or bolts.**

17. Each outrigger must be visible to the operator or the signal person during extension and retraction.

## Handling Load

### Size of Load

1. The crane must not be loaded beyond the applicable static or dynamic ratings given in the Capacity Chart for the crane configuration.

**NOTE:** Capacity charts for Manitowoc cranes show the total weight of freely suspended loads for various boom and jib lengths and operating radii.

**“Freely suspended load”** is a load that is hanging free with no direct external force applied except by the crane’s load-line reeving.

To determine the actual weight of the load which can be lifted at a given radius (working load), the operator must deduct the weight of certain lifting equipment from the total weight given in the chart. See the specific Capacity Chart for your crane for a list of lifting equipment which must be deducted.

The operator’s judgment must be used to further reduce the total load to allow for the dynamic effects of swinging, hoisting, or lowering, and adverse weather conditions to include wind.

2. The operator or other designated person directing the lift shall verify that the weight of load is within the static or dynamic rating for radius at which load will be lifted.

**Verified weights and measured radii must take priority over RCI/RCL readings.**

### Attaching Load

1. Attach the hook to the load with slings, or other suitable rigging. Each hook must have a latch that is in proper working order. **Hook latches must not be wired open.**
  - a. Inspect each hook and latch before using.
  - b. Never use a hook or latch that is distorted or bent.
  - c. Make sure spring will force the latch against the tip of the hook.
  - d. Make sure the hook supports the load. The latch must never support the load. Latches are only intended to retain loose slings under slack conditions.
2. Only use slings and other rigging that are in safe operating condition and have a rating equal to or greater than the load to be lifted.
3. Do not wrap the load line around the load.
4. Use suitable protection between slings and any sharp edges on the load. When synthetic slings are used, the synthetic sling manufacturer’s instructions, limitations, specifications, and recommendations must be followed.



5. Secure unused legs of a multi-leg sling before handling a load with one leg of sling.

### Lifting/Moving Load

1. Before lifting or moving a load, the operator or qualified person directing the lift shall make the following checks:

- a. Crane has a firm, uniformly supporting foundation under all crawlers. Unless otherwise specified in the Capacity Chart, the foundation must be level to within 1% — 1ft (0,3 m) rise or fall in 100 ft (30,5 m) distance.

When such a surface is not available, it must be provided with timbers, cribbing, or other structural members to distribute the load such that the allowable bearing capacity of the underlying member is not exceeded.

For ground bearing data go to:  
www.manitowoccranes.com

- b. The load is secured and properly balanced in the slings or the lifting device before lifting the load more than 3 to 6 in (76 to 152 mm).
- c. The lift and swing paths are clear of personnel and obstructions.
- d. The load is free to be lifted.
- e. The load line is not kinked or otherwise damaged.
- f. Multiple part load lines are not twisted around each other in such a manner that the lines will not separate when the load is lifted.
- g. The hook is brought over the load in a manner that will minimize twisting or swinging.
- h. The load line and the boom hoist rope are properly spooled on the drums and seated in the sheaves.
- i. The load drum brakes are in proper working order.

The operator shall test the load drum brakes each time a load approaching the rated load is handled. Lift the load 3 to 6 in (76 to 152 mm) and fully apply the brakes — load must not lower through applied brakes.

- j. Unused load drums are parked (working and parking brakes applied. If equipped, drum pawls engaged).
- k. All personnel are clear of the swing radius of the crane's counterweight.

2. While lifting or moving the load, the operator shall take the following precautions:

- a. Accelerate and decelerate the load smoothly to avoid excessive stress on the crane boom and machinery.

- b. Avoid sudden starts and stops while swinging. Keep the swing speed under control to prevent the load from swinging out beyond the radius at which the load can be handled and to minimize the pendulum action of the load.

- c. Sound the signal horn before swinging and intermittently while swinging, especially when approaching personnel.

If equipped, the automatic swing alarm will sound when the crane is swung.

- d. Use taglines or other restraints to control the load when necessary.

- e. Do not exceed any swing limitations (areas of operation) given in the Capacity Chart.

- f. Do not allow the load, the boom, or any other part of the crane to contact obstructions.

- g. Do not use the crane to drag a load.

- h. Do not hoist, lower, or swing the load while personnel are on the load or the hook. See Personnel Handling topic in this section.

- i. Avoid carrying the load over personnel. Loads which are suspended must be blocked or cribbed before personnel are allowed to work under or between them.

- j. Before lifting a load which requires the use of outriggers (or anytime outriggers are used), fully extend the outrigger beams and jacks so the truck tires do not bear any load.

Securely fasten the outrigger jack pads or floats to jacks and set them on a flat, firm surface that will support the load placed on the pads or floats. Do not set the jack pads or floats in holes, on rocky ground, or on extremely soft ground.

When dictated by ground conditions, install wood blocking or steel plates under the jack pads or floats to properly distribute the loading on the supporting surface.

Wood blocking or steel plates used under the jack pads or floats must be:

- Free of defects
- Strong enough to prevent crushing, bending, or shear failure
- Of sufficient thickness, width, and length to completely support the jack pad or float, transmit the load to the supporting surface, and prevent shifting, toppling, or excessive settlement under load

- k. Fully retract and lock the jacks and the outrigger beams so they cannot extend when not in use.

- I. Operate with extreme caution when using two or more cranes to lift the same load.

One designated person shall be responsible for operation when two or more cranes are used to lift same load. The designated person shall analyze the lift and instruct all personnel involved in proper rigging and positioning of the load and all movements to be made. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements must be in accordance with the designated person's decision.

- m. Do not lower the load or the boom to a point where less than three full wraps of wire rope are remaining on the respective drum (or as otherwise indicated in local, state, or federal regulations).
- n. Engage the boom hoist pawl when operating with the boom at a fixed radius.
- o. Engage the luffing hoist pawl when operating with the luffing jib at a fixed radius.

- 3. While traveling, the operator shall take the following precautions:

- a. Sound the signal horn before traveling and intermittently while traveling, especially when approaching personnel.

If equipped, the automatic travel alarm will sound when the crane is traveled.

- b. Carry the boom in-line with the lowerworks and facing the direction of travel.
- c. Do not position the boom so high that it could bounce over backwards whether traveling with or without load.
- d. Secure the rotating bed against rotation except:
  - When operating with a MAX-ER® attachment
  - When it is necessary to negotiate a turn, and then only when the operator is seated at controls or the boom is supported on a dolly
- e. Lash or otherwise restrain unused hooks so they cannot swing freely.

- 4. Before traveling with a load, the operator shall take the following additional precautions:

- a. A designated person shall be responsible for operation. Decisions such as the necessity to reduce crane ratings, load position, boom position, ground support, and speed of movements must be in accordance with the designated person's decision.
- b. Maintain specified tire pressures (truck cranes).

- c. Avoid sudden starts and stops. Use taglines or other restraints to control the position of the load.

### Multiple Load Line Operation



## WARNING

### Avoid Over Load and Side Load Damage to Crane

Manitowoc highly recommends that you contact your Maniowoc dealer for lift planning assistance and approval.

Multiple load line operation is becoming common practice for applications like panel tilt-up, pile tilt-up, pile driving, rolling fabricated sections, etc. The multiple lines may be on a common shaft (each with different parts of line) or on multiple shafts (lower boom point and upper point, boom point and fixed jib point, etc).

Manitowoc authorizes multiple load line operation for those applications requiring it, provided the following steps are performed:

1. The qualified lift planner and the crane operator shall read and become thoroughly familiar with the appropriate Capacity Charts and Wire Rope Specification Charts.
2. The lift planner and the crane operator shall make sure the total load does not exceed the rated capacity given in the Capacity Chart and Wire Rope Specification Chart for given boom point or jib point, whichever is less.
 

EXAMPLE: If one load line is lifting from the jib point, the proper jib chart applies.
3. The crane shall be thoroughly inspected by a qualified person prior to setup.
4. The crane shall be thoroughly inspected for load line interference caused by routing and reeving of multiple load lines. If interference is found, it shall be eliminated.
5. For cranes produced before 2003, Rated Capacity Indicators/Limiters were not required by ASME B30.5 for non-personnel lifting.

To aid the operator in staying within the crane's Capacity Chart with the total applied load, Maniowoc recommends that its cranes be equipped with Rated Capacity Indicators/Limiters to monitor the load on each load line.

***Operator is still responsible for knowing load and radius whether or not crane is equipped with load indicator(s).***

6. Maniowoc recommends that each load line be equipped with an anti-two-block device.

7. Manitowoc's Capacity Charts are based on freely suspended loads. To prevent side load damage to the boom, the jib, and the sheaves:
  - The load lines must hang as close to vertical as possible to minimize side and forward loads.
 

The distance between the load points and the hook points must be a minimum of three times the horizontal distance between the hook point on the load being lifted.
  - The load must remain centered on the boom and jib point shafts unless special lift approval is granted by Manitowoc.
  - The load lines should be located over the load's center of gravity as it is supported on a trailer, a barge, or the ground.
8. The crane operator shall be familiar with the operational characteristic of the crane as it relates to multiple drum operation (simultaneous operation, same or opposite direction, or individual operation).
9. When using tandem drums, the maximum operating layers may be limited depending on whether the crane was initially designed for tandem drum operation or not.
10. Load shift when lifting with two hooks may be more unpredictable than typical one hook lifting.

### **Holding Load**

When a load is suspended, the operator shall take the following precautions:

1. Not leave his/her position at the controls
2. Not allow personnel to stand or pass under the load
3. Move all controls to off, apply all drum brakes, engage the boom hoist pawl, and apply the swing and travel brakes or locks.

## **SIGNALS**

1. Continuous communication shall be maintained between the operator and the signal person during all crane movements. If communication is disrupted, **operator shall stop all crane movements.**
2. Signals to the operator shall be in accordance with the standard signals shown in Section 3, unless communications equipment (telephone, radio, etc.) is used.
3. All signals must be easily understood by the operator at all times. The operator shall not respond to any signal which is not clearly understood.
4. For operations not covered in the standard signals, or for special situations or emergencies, additional signals may be required. In those cases, the signals used shall be agreed upon in advance by the operator and the signal person. The signals used must not conflict with or have potential to be confused with the standard signals.
5. When it is necessary to give instructions to the operator (other than those established by the signal system), all crane motions shall be stopped.
6. The signal person shall:
  - a. Be tested by a designated person and show that he or she has a basic understanding of crane operations and limitations, to include boom deflection.
  - b. Be thoroughly familiar with the standard hand signals and voice signals if used.
  - c. Be positioned in clear view of the operator. The signal person's position should give him or her a clear view of the load, the crane, and the operating area.
  - d. Direct the load so it does not pass over personnel.
  - e. Keep unnecessary personnel out of the crane's operating area.
7. When moving the crane, the following audible signals must be used:
  - a. STOP - one short audible signal
  - b. GO AHEAD - two short audible signals
  - c. BACK UP - three short audible signals

## SAFETY DEVICES



### WARNING

Do not operate crane unless all safety devices listed in this section are in proper working order.

- If a safety device stops working properly during operation, the operator must safely stop operation.
- If any safety device listed in this section is not in proper working order, the safety device must be taken out of service and crane operation must not resume until the safety device is again working properly.
- Alternative measures are not permitted to be used for a faulty safety device.
- Always tag-out any faulty safety device and place a warning tag in the cab stating that the crane is out of service and must not be used.

Manitowoc provides the following safety devices on its cranes.

1. Horn activated by a switch on the control console in the operator's cab.  
If the horn is not working properly, it must be tagged-out or removed, if possible.
2. Crane level indicator: either electronic (viewable in crane's electronic display) or mechanical (viewable from operator's cab seat). If the crane level indicator is not working properly, it must be tagged-out or removed, if possible.
3. Cranes operating on a barge require: a trim indicator, a swing brake, and a wind direction indicator if the wind is a factor (supplied by crane owner or user).
4. Boom stops, both physical and automatic.  
If a boom stop is damaged or not working properly, it must be tagged-out or removed if possible.
5. Jib stops, both physical and automatic (for fixed jib and luffing jib).  
If a jib stop is damaged or not working properly, it must be tagged-out or removed, if possible.
6. Pedal locks for all foot-operated brakes (if applicable).  
If a pedal lock is damaged or not working properly, it must be tagged-out or removed if possible.
7. An integral holding device or check valve on each jacking cylinder.

## OPERATIONAL AIDS



### WARNING

Do not operate crane unless all applicable operational aids listed in this section are in proper working order, except:

- Where an operational aid is being repaired
- The crane user implements a specified temporary alternative measure

If an operational aid stops working properly during operation, the operator must safely stop operation until the temporary alternative measures are implemented or the device is again working properly.

Manitowoc provides the following operational aids on its cranes, either as standard equipment or optional equipment. The operational aids are designated as Category 1 or Category 2:

### Category 1 Operational Aids

If a Category 1 operational aid is not working properly, it must be repaired no later than 7 calendar days after the deficiency occurs.

Exception: If the crane user documents that he/she has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, the repair must be completed within 7 calendar days of receiving the parts.

#### 1. Boom or Luffing Jib Angle Limiter (automatic boom or jib stop)

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall make sure the maximum boom or jib angle/radius specified in the Capacity Chart for the load being handled is not exceeded. One or more of the following methods must be used:

- a. Measure radius using a tape measure.
- b. Measure the boom angle with a protractor-level on the centerline of boom.
- c. Clearly mark the boom or luffing hoist cable (so it can easily be seen by the operator) at a point that gives the operator sufficient time to stop the boom or jib within the minimum allowable radius.

In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

- d. Clearly mark the boom or luffing hoist cable (so it can easily be seen by a designated signal person) at a point that gives the signal person sufficient time to signal the operator and have the operator stop the boom or jib within the minimum allowable radius.

## 2. Anti-Two-Block Device

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection. One or more of the following methods must be used:

- a. Assign a signal person to signal the operator to stop hoisting when the load is a safe distance from the boom or jib point.
- b. Clearly mark the hoist cable (so it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the load a safe distance from the boom or jib point.

**NOTE:** The temporary alternative measures for the anti-two-block device do not apply when lifting personnel in load line supported baskets. ***Personnel shall not be lifted in load line supported baskets when anti-two-block devices are not functioning properly.***

## Category 2 Operational Aids

If a Category 2 operational aid is not working properly, it must be repaired no later than 30 calendar days after the deficiency occurs. Exception: if the employer documents that it has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 calendar days, the repair must be completed within 7 calendar days of receiving the parts.

### 1. Rated Capacity Indicator/Limiter

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures for determining load weights and shall make sure that the weight of the load does not exceed the crane's rating at the radius where the load is handled.

The weight of the load must be provided to the operator before the lift is made.

### 2. Boom Angle or Radius Indicator

Temporary alternative measures if inoperative or malfunctioning:

- a. Refer to the pendulum boom angle indicator on the boom butt (viewable from operator's cab).
- b. Measure the boom angle with a protractor-level on the centerline of boom.
- c. Measure radius using a tape measure.

### 3. Jib Angle or Radius Indicator

Temporary alternative measures if inoperative or malfunctioning. Use either or both:

- a. First, make sure you know the boom angle (see item 2 above).
- b. Then, measure radius using a tape measure.

### 4. Drum Rotation Indicator

Temporary alternative measures if inoperative or malfunctioning:

Mark the drum to indicate its rotation.

If the operator cannot see the drum, add mirrors or remote video cameras and displays so the operator can see the mark.

### 5. OPTIONAL Swing Limiter or Proximity Device

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift shall establish procedures to furnish equivalent protection (for example, assign an additional signal person to observe the distance between the boom or load and job site obstructions to include power lines or to limit the swing sector specified in the Capacity Chart).

### 6. OPTIONAL Drum Spooling Limiter (maximum or minimum bail limit)

Temporary alternative measures if inoperative or malfunctioning:

The qualified person directing the lift, the operator, or a designated signal person shall watch the drum and signal the operator to stop it before it is over spooled (rope does not jump off drum) or before there are less than 3 full wraps of wire rope on the load drum or boom hoist.

### 7. OPTIONAL Closed-Circuit Television (CCTV)

Temporary alternative measures if inoperative or malfunctioning:

A designated signal person shall watch the load, the drums, and the counterweight and provide necessary hand or voice signals to the crane operator.

## ASSEMBLING, DISASSEMBLING, OR OPERATING CRANE NEAR ELECTRIC POWER AND TRANSMISSION LINES

### Electrocution Hazard

Thoroughly read, understand, and abide by all applicable federal, state, and local regulations regarding operation of cranes near electric power lines or equipment.

***United States federal law prohibits the use of cranes closer than 20 ft (6 m) to power sources up to 350 kV and greater distances for higher voltages unless the line's voltage is known [29CFR1910.180 and 29CFR1926.1400].***

***To avoid death or serious injury, Manitowoc recommends that all parts of crane, boom, and load be kept at least 20 ft (6 m) away from all electrical power lines and equipment less than 350 kV.***

**NOTE:** For detailed guidelines on operating near power lines, refer to the current edition of OSHA 29CFR1926.1400 and ASME B30.5 American National Standard.



### WARNING

#### Electrocution Hazard!

Manitowoc cranes are not equipped with all features required to operate within OSHA 29CFR1926.1408, Table A clearances when the power lines are energized.

1. Keep all personnel and their personal belongings (clothing, water coolers, lunch boxes, etc.) away from the crane if it is being operated near electrical power lines or equipment.
2. Before operating the crane in the vicinity of electrical power lines or equipment, notify the power utility company. Obtain positive and absolute assurance that the power has been turned off.

The crane is NOT INSULATED. Always consider all parts of the load and the crane as conductors, including the wire rope, pendants or straps, and taglines.

Most overhead power lines ARE NOT insulated. Treat all overhead power lines as being energized unless you have reliable information to the contrary from the utility company or owner.

The rules in this section must be followed at all times, even if the electrical power lines or equipment have been de-energized.

3. Crane operation is dangerous when close to an energized electrical power source. Exercise extreme caution and prudent judgment. Operate slowly and cautiously when in the vicinity of power lines.
4. If the load, wire rope, boom, or any portion of the crane contacts or comes too close to an electrical power source, everyone in, on, and around the crane can be seriously injured or killed.

The safest way to avoid electrocution is to stay away from electrical power lines and electrical power sources.

5. The operator is responsible for alerting all personnel to the dangers associated with electrical power lines and equipment. The crane is not insulated. Do not allow unnecessary personnel in the vicinity of the crane while operating. Permit no one to lean against or touch the crane. Permit no one, including riggers and load handlers, to hold the load, load lines, taglines, or rigging gear.
6. Even if the crane operator is not affected by an electrical contact, others in the area may become seriously injured or killed.
7. It is not always necessary to contact a power line or power source to become electrocuted. Electricity, depending on magnitude, can arc or jump to any part of the load, load line, or crane boom if it comes too close to an electrical power source. Low voltages can also be dangerous.

### Set-Up and Operation

1. During crane use, assume that every line is energized ("hot" or "live") and take necessary precautions.
2. Position the crane such that the load, boom, or any part of the crane and its attachments cannot be moved to within 20 ft (6 m) of electrical power lines or equipment. This includes the crane boom and all attachments. Overhead lines tend to blow in the wind, so allow for movement of the overhead lines when determining a safe operating distance.
3. Erect a suitable barricade to physically restrain the crane, all attachments, and the load from entering into an unsafe distance from electrical power lines or equipment.
4. Plan ahead and always plan a safe route before traveling under power lines. A wooden clearance frame should be constructed to ensure sufficient clearance is maintained between crane and power lines.
5. Appoint a reliable and qualified signal person, equipped with a loud signal whistle or horn and voice communication equipment, to warn the operator when any part of the crane or load moves near a power

source. This person should have no other duties while the crane is working.

6. Taglines should always be made of non-conductive materials. Any tagline that is wet or dirty can conduct electricity.
7. DO NOT store materials under power lines or close to electrical power sources.
8. When operating near transmitter/communication towers where an electrical charge can be induced into the crane or load:
  - The transmitter must be deenergized OR,
  - Tests shall be made to determine if an electrical charge will be induced into the crane or load
  - The crane must be provided an electrical ground
  - If taglines are used, they must be non-conductive
  - Every precaution must be taken to dissipate induced voltages. Consult with a qualified RF (radio frequency) Consultant. Also refer to local, state, and federal codes and regulations

### Electrocution Hazard Devices

1. The use of insulated links, insulated boom cages/guards, proximity warning devices, or mechanical limit stops does not ensure that electrical contact will not occur. Even if codes or regulations require the use of such devices, failure to follow the rules in this section may result in serious injury or death.
  2. Be aware that such devices have limitations and you should follow the rules and precautions outlined in this section at all times even if the crane is equipped with these devices.
  3. Insulating links installed into the load line afford limited protection from electrocution hazards. Links are limited in their lifting abilities, insulating properties, and other properties that affect their performance. Moisture, dust, dirt, oils, and other contaminants can cause a link to conduct electricity. Due to their capacity ratings, some links are not effective for large cranes and/or high voltages/currents.
  4. The only protection that may be afforded by an insulated link is below the link (electrically downstream), provided the link has been kept clean, free of contamination, has not been scratched or damaged, and is periodically tested (just before use) for its dielectric integrity.
  5. Boom cages and boom guards afford limited protection from electrocution hazards. They are designed to cover only the boom nose and a small portion of the boom. Performance of boom cages and boom guards is limited by their physical size, insulating characteristics, and operating environment (e.g. dust, dirt, moisture, etc.).
- The insulating characteristics of these devices can be compromised if not kept clean, free of contamination, and undamaged.
6. Proximity sensing and warning devices are available in different types. Some use boom point (localized) sensors and others use full boom length sensors. No warning may be given for components, cables, loads, and other attachments located outside of the sensing area. Reliance is placed upon the operator in selecting and properly setting the sensitivity of these devices.
  7. Never rely solely on a device to protect you and your fellow workers from danger.
- Some variables you must know and understand are:
- Proximity devices are advertised to detect the existence of electricity and not its distance, quantity, or magnitude
  - Some proximity devices may detect only alternating current (AC) and not direct current (DC)
  - Some proximity devices detect radio frequency (RF) energy and others do not
  - Most proximity devices simply provide a signal (audible, visual, or both) for the operator and this signal must not be ignored
  - Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources
8. DO NOT depend on grounding. Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the (wire) conductor used, the condition of the ground, the magnitude of the voltage and current present, and numerous other factors.

### Electrical Contact

If the crane comes in contact with an energized power source, the operator must:

1. Stay in the crane cab. DON'T PANIC.
2. Immediately warn PERSONNEL in the vicinity to STAY AWAY.
3. Attempt to move the crane away from the contacted power source using the crane's controls which are likely to remain functional.
4. Stay in the crane until the power company has been contacted and the power source has been de-energized. NO ONE must attempt to come close to the crane or load until the power has been turned off.

Only as a last resort should an operator attempt to leave the crane upon contacting a power source. If it is absolutely necessary to leave the cab, JUMP

COMPLETELY CLEAR OF CRANE. DO NOT STEP OFF. Hop away with both feet together. DO NOT walk or run.

- Following any contact with an energized electrical source, your Manitowoc dealer must be immediately advised of the incident and consulted on necessary inspections and repairs.

If the dealer is not immediately available, contact Manitowoc Crane Care at the factory. The crane must not be returned to service until it is thoroughly inspected for any evidence of damage and all damaged parts are repaired or replaced as authorized by Manitowoc or your Manitowoc dealer.

## REFUELING

- When using a portable container to refuel the crane, the container must be a safety-type can equipped with an automatic closing cap and a flame arrester.
- The engine must be **stopped** before refueling crane.
- Smoking and open flames must be prohibited in refueling area.

## FIRE EXTINGUISHERS

- A portable fire extinguisher with a minimum rating of 10 BC must be installed in operator's or machinery cab of crane.
- The operator and all maintenance personnel shall be thoroughly familiar with the location, use, and care of the fire extinguisher(s) provided.

## ACCIDENTS

If this crane becomes involved in a property damage and/or personal injury accident, immediately contact your Manitowoc dealer or the Product Safety and Reliability Department at the following address:

**Manitowoc Cranes**  
2401 So. 30th St.  
Manitowoc, WI 54220  
Phone: 920-684-6621

Provide a complete description of the accident, including the crane model and serial number.

The crane must not be returned to service until it is thoroughly inspected for any evidence of damage. All damaged parts must be repaired or replaced as authorized by Manitowoc.

## SAFE MAINTENANCE



### WARNING

Importance of safe maintenance cannot be over emphasized. Carelessness and neglect on part of maintenance personnel can result in their death or injury and costly damage to the crane or property.

Safety information in this publication is intended only as a guide to assist qualified maintenance personnel in safe maintenance. Manitowoc cannot foresee all hazards that will arise in field. Therefore, **safety remains responsibility of maintenance personnel and crane owner.**

## Maintenance Instructions

To ensure safe and proper operation of Manitowoc cranes, they must be maintained according to the instructions contained in this manual and in the Service Manual provided with the crane.

Crane maintenance and repair must be performed by qualified personnel. These personnel must **read Operator Manual and Service Manual before attempting any maintenance procedure.** If there is any question regarding maintenance procedures or specifications, contact your Manitowoc dealer for assistance.

**Qualified person** is defined as one who by reason of training and experience is thoroughly familiar with the crane's operation and required maintenance as well as the hazards involved in performing these tasks.

**Training and qualification of maintenance and repair personnel are crane owner's responsibility.**

## Safe Maintenance Practices

- Perform the following steps (as applicable) before starting a maintenance procedure:
  - Park the crane where it will not interfere with other equipment or operations.
  - Lower all loads to the ground or otherwise secure them against movement.
  - Lower the boom onto blocking at ground level, if possible, or otherwise secure the boom against dropping.
  - Move all controls to off and secure all functions against movement by applying or engaging all brakes, pawls, or other locking devices.
  - Stop the engine and render the starting means inoperative.



- f. Place a warning sign at the start controls alerting other personnel that crane is being serviced and the engine must not be started. **Do not remove sign until it is safe to return crane to service.**
2. Do not attempt to maintain or repair any part of the crane while the engine is running, unless absolutely necessary.  
If the engine must be run, keep your clothing and all parts of your body away from moving parts. **Maintain constant verbal communication between person at controls and person performing maintenance or repair procedure.**
  3. Wear clothing that is relatively tight and belted.
  4. Wear appropriate eye protection and approved hard hat.
  5. Never climb onto or off a moving crane. **Climb onto and off crane only when it is parked and only with operator's permission.**  
Use both hands and handrails, steps and ladders provided to climb onto and off the crane.  
Lift tools and other equipment which cannot be carried in pockets or tool belts onto and off the crane with hand lines or hoists.
  6. The boom and gantry are not intended as ladders. Do not attempt to climb lattice work of the boom or gantry to get to maintenance points. If the boom or gantry is not equipped with an approved ladder, lower them before performing maintenance or repair procedures.
  7. Do not remove cylinders until the working unit has been securely restrained against movement.
  8. Pinch points are impossible to eliminate. Watch for them closely.
  9. Pressurized air, coolant, and hydraulic oil can cause serious injury. Make sure all air, coolant, and hydraulic lines, fittings, and components are tight and serviceable.  
**Do not use your hands to check for air, coolant or hydraulic oil leaks:**
    - Use a soap and water solution to check for air leaks (apply to fittings and lines and watch for bubbles).
    - Use a piece of cardboard or wood to check for coolant and hydraulic oil leaks.
  10. Relieve pressure before disconnecting air, coolant, and hydraulic lines and fittings.
  11. Do not remove the radiator cap while the coolant is hot or under pressure. Stop the engine, wait until the pressure drops and the coolant cools, then slowly remove the cap.
  12. Avoid battery explosion: do not smoke while performing battery maintenance or short across battery terminals to check its charge.
  13. Read the safety information in the battery manufacturer's instructions before attempting to charge a battery.
  14. Avoid battery acid contact with skin and eyes. If contact occurs, flush the area with water and immediately consult a doctor.
  15. Stop the engine before refueling crane.
  16. Do not smoke or allow open flames in refueling area.
  17. Use a safety-type can with an automatic closing cap and flame arrestor for refueling.
  18. Hydraulic oil can also be flammable. Do not smoke or allow open flames in the area when filling hydraulic tanks.
  19. Never handle wire rope with bare hands. Always wear heavy-duty gloves to prevent being cut by broken wires.
  20. Use extreme care when handling coiled pendants. Stored energy can cause the coiled pendants to uncoil quickly with considerable force.
  21. When inflating tires, use a tire cage, a clip-on inflater, and an extension hose which permits standing well away from the tire.
  22. Only use cleaning solvents which are non-volatile and non-flammable.
  23. Do not attempt to lift heavy components by hand. Use a hoist, jacks, or blocking to lift components.
  24. Use care while welding or burning on the crane. Cover all hoses and components with non-flammable shields or blankets to prevent a fire or other damage.
  25. To prevent damage to crane parts (bearings, cylinders, swivels, slewing ring, computers, etc.), perform the following steps **before welding on crane:**
    - Disconnect all cables from batteries.
    - Disconnect output cables at engine junction box.
    - Attach the ground cable from the welder directly to the part being welded and as close to the weld as possible.

Do not weld on the engine or engine mounted parts (per engine manufacturer).
  26. Disconnect and lock the power supply switch before attempting to service high voltage electrical components and before entering tight areas (such as carbody openings) containing high voltage components.
  27. When assembling and disassembling booms, jibs, or masts on the ground (with or without support of boom

rigging pendants or straps), securely block each section to provide adequate support and alignment.

**Do not go under boom, jib, or mast sections while connecting bolts or pins are being removed.**

28. Unless authorized in writing by Manitowoc, do not alter the crane in any way that affects the crane's performance (to include welding, cutting, or burning of structural members or changing pressures and flows of air/hydraulic components). Doing so will invalidate all warranties and Capacity Charts and make the crane owner/user liable for any resultant accidents.
29. **Keep crane clean.** Accumulations of dirt, grease, oil, rags, paper, and other waste will not only interfere with safe operation and maintenance but also create a fire hazard.
30. Store tools, oil cans, spare parts, and other necessary equipment in tool boxes. Do not allow these items to lie around loose in the operator's cab or on walkways and stairs.
31. Do not store flammable materials on the crane.
32. Do not return the crane to service at completion of maintenance or repair procedures until all guards and covers have been reinstalled, trapped air has been bled from hydraulic systems, safety devices have been

reactivated, and all maintenance equipment has been removed.

33. Perform a function check to ensure proper operation at the completion of maintenance or repair.

## Environmental Protection

**Dispose of waste properly!** Improperly disposing of waste can threaten the environment.

Potentially harmful waste used in Manitowoc cranes includes — but is not limited to — oil, fuel, grease, coolant, air conditioning refrigerant, filters, batteries, and cloths which have come into contact with these environmentally harmful substances.

Handle and dispose of waste according to local, state, and federal environmental regulations.

When filling and draining crane components: do not pour waste fluids onto the ground, down any drain, or into any source of water.

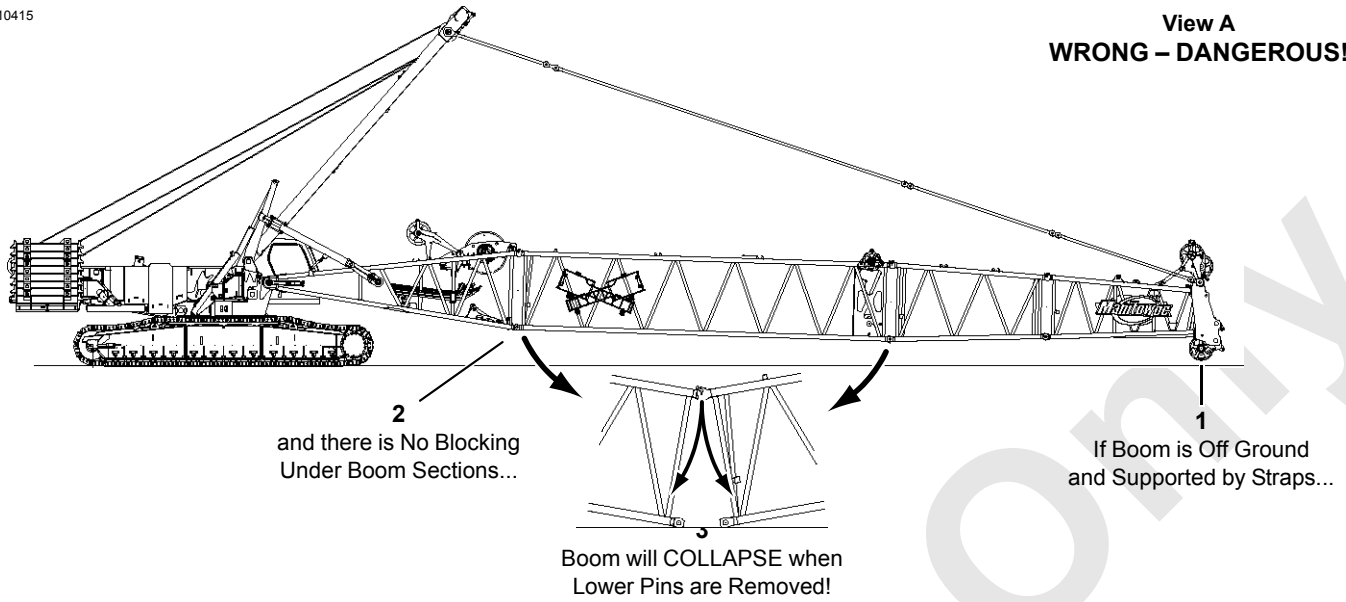
- Always drain waste fluids into leak proof containers that are clearly marked with what they contain
- Always fill or add fluids with a funnel or a filling pump
- Immediately wipe up any spills

Reference Only

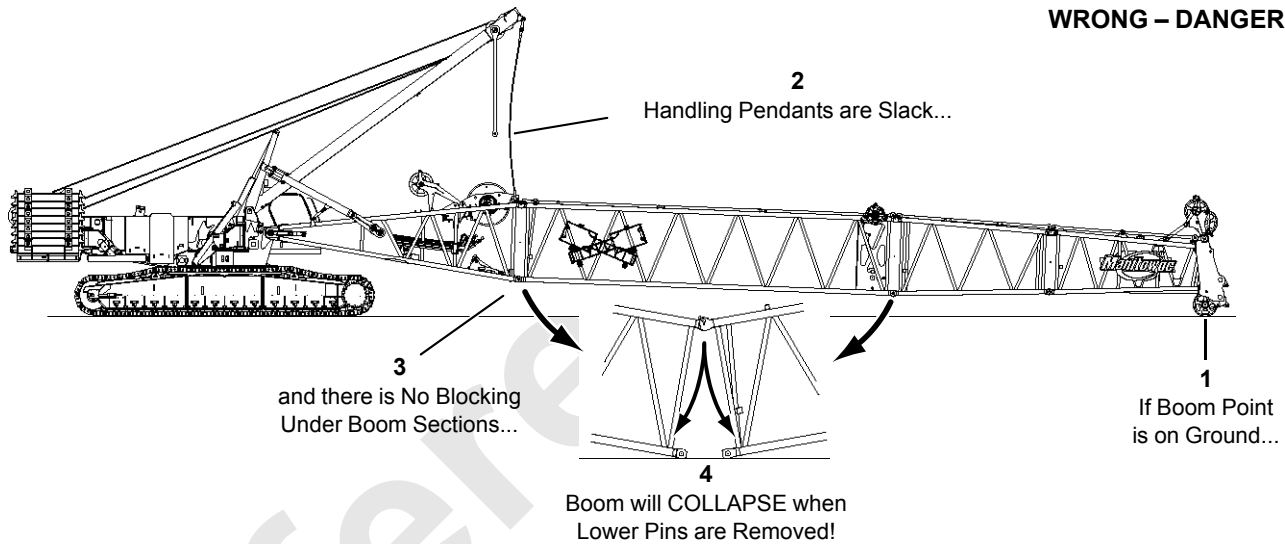
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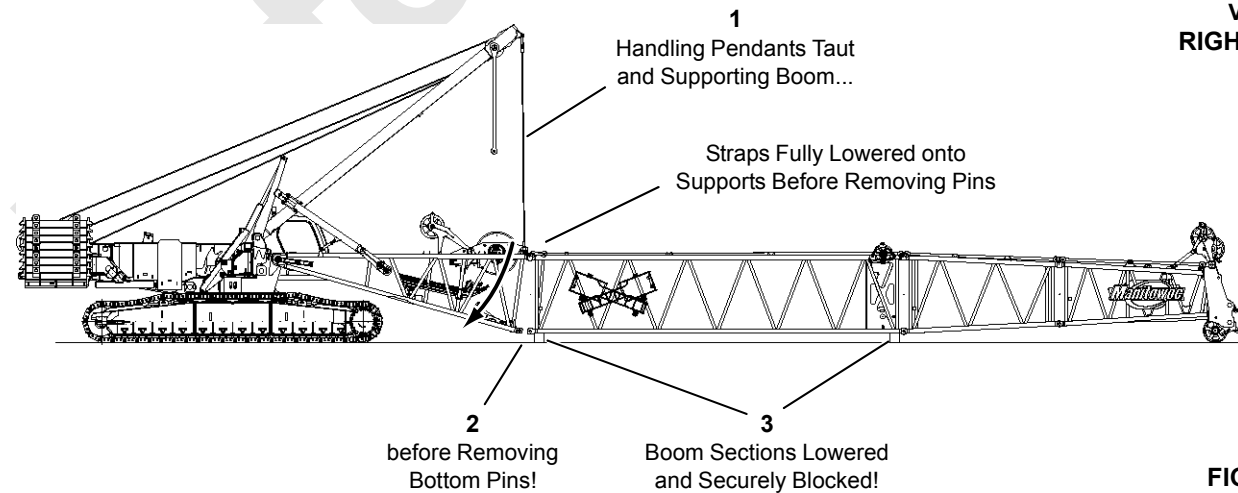
**View A  
WRONG – DANGEROUS!**



**View B  
WRONG – DANGEROUS!**



**View C  
RIGHT – SAFE**



**FIGURE 2-4**

## BOOM DISASSEMBLY SAFETY

**NOTE:** The term “boom” used in the following instructions applies to all lattice attachments (fixed jib, luffing jib, mast, etc.).



### DANGER!

#### Collapsing Boom Hazard!

Prevent death or serious injury when disassembling boom sections — read and adhere to following instructions.

Safe handling of lattice booms during disassembly is a primary concern for preventing serious or fatal injuries. A boom can collapse during disassembly if workers fail to observe safe working practices.

Accidents during boom disassembly usually result from one of three primary causes:

- Workers are not familiar with equipment or are not properly trained
- Disassembly area is not suitable
- Safe procedures are overlooked because not enough time is allocated for the task

### General

Safety decals ([Figure 2-5](#)) are placed near the connectors on the boom sections as shown on the Boom Disassembly Decal Drawing at the end of this section.

Workers involved with boom disassembly must be trained and experienced in the operation and disassembly of construction cranes. Everyone must read and understand these instructions, the information in the Boom Assembly Drawing, and the instructions in Section 4 before beginning disassembly. Anyone who has a question should ask for an explanation. **One worker who does not fully understand or fails to follow correct procedures can endanger other workers.**

### Location

Select a suitable location for boom disassembly. It must be firm, level, and be free of obstructions. It should have enough open space to accommodate the crane, the length of boom, and – if required – movement of an assist crane or other equipment. If possible, secure the area to keep unauthorized personnel and vehicles away.

### Pin Removal

When removing pins from boom sections, stand clear of pins being removed. Even though the boom is resting on

blocking, individual pin connections may still be under load. Pins can be ejected forcefully if the boom has any pressure on it or if the boom is not supported properly.



FIGURE 2-5

## Disassembly Precaution

Always block boom sections so they are securely supported and cannot shift or move suddenly when pins are removed. If there is any doubt about a boom disassembly procedure, **block tightly under boom sections before removing any pin.**



### DANGER

#### Collapsing Boom Hazard!

Boom can collapse or jerk when pins are removed. To avoid death or serious injury:

- Do not remove bottom connecting pins from any boom section when boom is supported by straps as shown in [Figure 2-4](#), View A.
- Do not remove strap connecting pins until straps are fully lowered into supports as shown in [Figure 2-4](#), View C.
- Do not remove bottom connecting pins from any boom section when boom point is resting on ground and handling pendants are slack as shown in [Figure 2-4](#), View B.
- Never work or stand inside boom unless it is lowered and securely blocked as shown in [Figure 2-4](#), View C.
- Do not stand or walk on top of boom unless it has walkways.



### DANGER

#### Falling Boom Hazard!

Crane can tip or boom can collapse if excess boom is cantilevered. Never cantilever more boom than allowed in rigging drawings or capacity charts.

## PERSONNEL HANDLING POLICY

In 1998, the American Society of Mechanical Engineers issued a new American National Standard entitled, Personnel Lifting Systems, ASME B30.23-1998. This standard provides, ***“lifting and lowering of personnel using ASME B30 Standard hoisting equipment shall be undertaken only in circumstances when it is not possible to accomplish the task by less hazardous means. Unless all of the applicable requirements of this volume are met, the lifting or lowering of personnel using ASME B30 Standard equipment is prohibited.”***

The ASME Standards recognize that mobile and locomotive cranes are primarily designed and intended for handling materials and not personnel. The ASME Standards have a retrofit statement that applies to existing cranes after the standards go into effect. It is not the intent of the standards to require retrofitting of existing equipment. If an item is being modified, the performance requirement shall be reviewed relative to the current standard.

This new standard is consistent with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations for Construction that state, in 29CFR1926.1431(a): ***The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the work site, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous or is not possible because of structural design or work site conditions.***

Use of a Manitowoc crane to handle personnel is acceptable provided:

- The crane user shall comply with the manufacturer’s specifications and limitations for lifting accessories (hooks, slings, personnel platforms, etc.).
- The requirements of the applicable national, state and local regulations and safety codes are met.
- A determination has been made that use of a crane to handle personnel is the least hazardous means to perform the work.
- The crane operator shall be qualified to operate the specific type of hoisting equipment used in the personnel lift.
- The crane operator must remain in the crane cab at all times when personnel are off the ground.
- The crane operator and occupants have been instructed in the recognized hazards of personnel platform lifts.
- The crane is in proper working order.
- Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls and dogs must be

engaged when the occupied personnel platform is in a stationary position.

- The crane must be equipped with a boom angle indicator that is visible to the crane operator.
- The crane must be equipped with boom hoist limiting device.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing jib angle indicator that is visible to the crane operator.
- If the luffing jib is used for hoisting personnel, the crane must be equipped with a luffing hoist limiting device.
- The crane is equipped with a positive acting device which prevents contact between the load block or overhaul ball and the boom tip (anti-two-block device).

For friction cranes, this implies the addition of spring applied brakes activated by the anti-two-block device. The load line hoist drum must have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering).

### ***Free fall of the hoist line is prohibited.***

- The 16000 Operator Manual is in the crane’s cab, readily accessible to the Operator.
  - The crane’s load Capacity Chart is affixed inside the crane cab, readily accessible to the operator. The total weight of the loaded personnel platform and related rigging must not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
  - The crane is uniformly level within one percent of level grade and located on a firm footing. Some Capacity Charts require more stringent levelness criteria.
- Cranes with outriggers or stabilizers must have them all extended and locked. All outriggers or stabilizers must be extended equally in accordance with the Capacity Charts and operating procedures.
- Handling personnel from a platform suspended by wire rope from a luffing jib is acceptable, but only when it is not possible to accomplish the task using a less hazardous means. The crane user and operator shall take into account hazards that may be present when using a luffing jib.
  - Direct attachment of a personnel platform to a luffing jib is prohibited.
  - The platform meets the requirements as prescribed by applicable standards and regulations.
  - Applicable personal protection equipment is provided (i.e., personal fall-protection system, etc.)

- For wire rope suspended platforms, the crane is equipped with a hook latch that can be closed and locked, eliminating the throat opening.
- The platform is properly attached and secure.
- Personnel platforms must not be used in winds exceeding 20 mph (9 m/s) at the hoisted platform height or in electric storms, snow, ice, sleet, or other adverse weather conditions which could affect the safety of personnel.
- Hoisting personnel within 20 ft (6 m) of a power line that is up to 350 kV or within 50 ft (15 m) of a power line that is over 350 kV is PROHIBITED, except for work covered in OSHA 29CFR1926 subpart V.

For operation outside the United States, the requirements of the applicable national, state and local regulations and safety codes must be met. This may include, in addition to the above:

- Automatic brakes such that when the equipment operating controls are released, the motions are brought to rest.

- A holding device (such as a load hold check valve) must be provided in the hydraulic or pneumatic systems to prevent uncontrolled movement of the hoisting equipment in the case of a system failure.

Manitowoc offers upgrade packages for friction controlled models to install anti-two-block, dead man control, and automatic hoist system control requirements to satisfy other codes and standards.

Manitowoc recommends that cranes be properly maintained, regularly inspected, and repaired as necessary. All safety signs must be in place and legible. We also urge Manitowoc crane owners to upgrade their cranes with rated capacity indicator/limiter systems for all lifting operations.

If you have any questions about this subject or other product safety matters relating to the operation and use of a Manitowoc crane, please contact your Manitowoc dealer or the Product Safety and Reliability Department at the following address:

**Manitowoc Cranes**

2401 So. 30th St.  
Manitowoc, WI 54220

Phone: 920-684-6621

## PEDESTAL/BARGE MOUNTED CRANES

### **WARNING** **Overload Hazard!**

A pedestal mounted crane will not tip to indicate to operator that crane's capacity has been exceeded. When capacity of a pedestal mounted crane is exceeded, hook rollers or other structural components may break, before load lines fail, causing crane to separate from pedestal.

For this reason, great care must be taken to operate a pedestal mounted crane within its rated capacity.

Careful planning is required before a crane can be operated on a barge. Crane user shall verify that barge is capable of limiting crane list and/or dynamics to maximum allowable specified in Capacity Charts. If specified crane list and/or dynamic conditions are exceeded, crane's capacity may be exceeded. Hook rollers or other structural components may break, causing crane to separate from pedestal.

### **WARNING**

Crane owner/user must verify that method used to fasten or restrain crane to foundation, barge, ship or floating platform is strong enough, under all operating conditions, to prevent crane from breaking off foundation or moving on barge.

Manitowoc does not permit use of a truck crane on a barge, ship or floating platform.

### Pedestal Mounted Crane

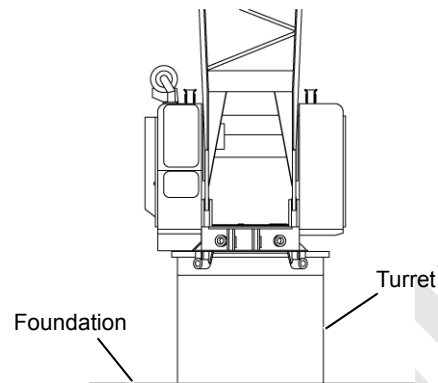
Also see ASME publication B30.8-2004, Floating Cranes and Derricks.

#### Definition

A pedestal mounted crane is a crane which is securely fastened to a foundation, barge, ship, or floating platform so the crane is restrained from tipping.

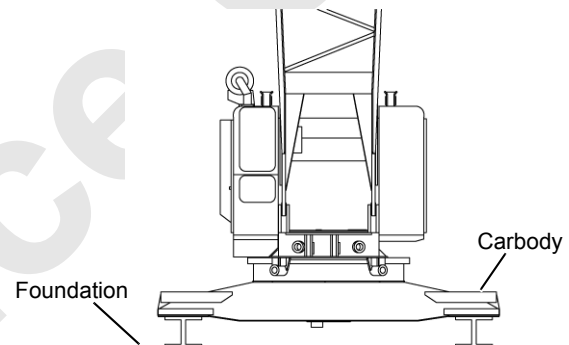
#### Examples

1. Crane rotating bed mounted on a turret (pedestal) which is securely fastened to the foundation ([Figure 2-6](#)).



**FIGURE 2-6**

2. Crane rotating bed mounted on a carbody (crawlers removed) which is securely fastened to the foundation ([Figure 2-7](#)).



**NOTE:** If bolting carbody to foundation, contact your Manitowoc dealer for recommended bolt pattern and for type and quantity of bolts to be used.

**FIGURE 2-7**

### Barge Mounted Crane

#### Definition

A barge mounted crane is a crane that is anchored or restrained in a work area of the barge, ship, or floating platform and is subjected to tipping forces.

#### Examples

**NOTE:** The foundation is the deck of the barge, ship, or floating platform.

1. Crawler-mounted crane with carbody anchored with tie-downs to the foundation ([Figure 2-8](#)).



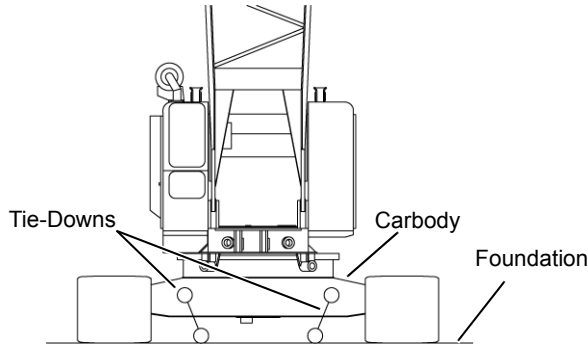
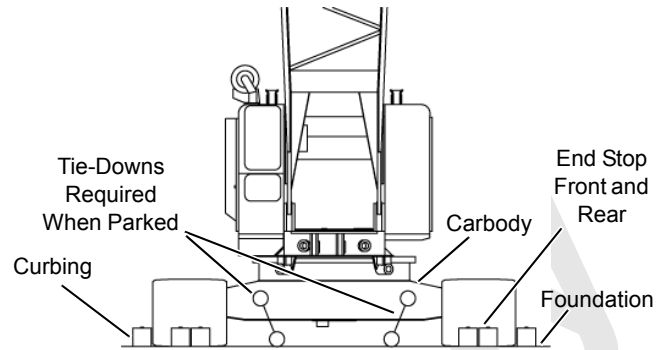


FIGURE 2-8

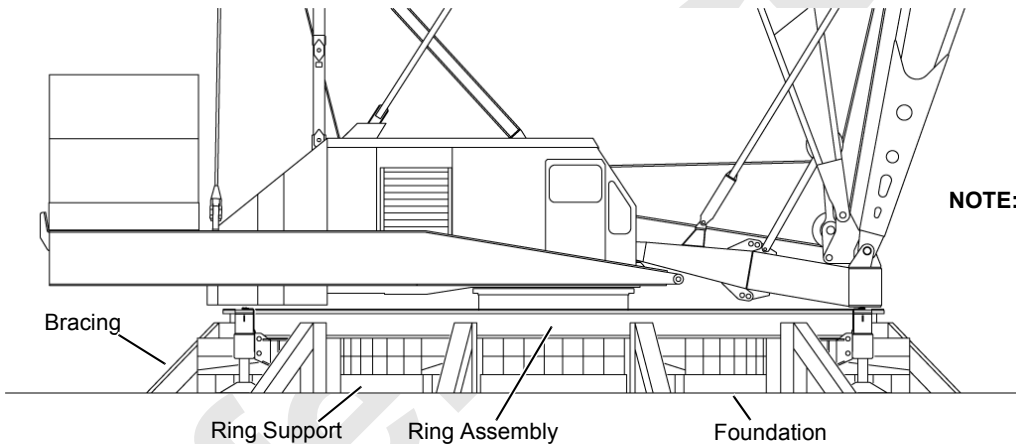


NOTE: Manitowoc does not permit traveling with load.

FIGURE 2-9

2. Crawler-mounted crane working on a timbered area of the barge, ship, or floating platform with the crawlers restrained by curbing and end stops (Figure 2-9). When not working, the crane carbody is anchored with tie-downs to the foundation. **Traveling with load is not permitted.**

3. RINGER® (crawler mounted, carbody mounted) supported on blocking, screw jacks, or steel pedestals which are braced and fastened to the foundation in such a manner as to prevent movement (Figure 2-10).
4. RINGER (platform mounted) which has the ring braced and fastened directly to the foundation in such a manner as to prevent movement.



NOTE: Ringers must be equipped with hook rollers on boom and counterweight carriers.

FIGURE 2-10

AXIS		TRANSITIONAL		ROTATIONAL	
SYMBOL	NAME	STATIC	DYNAMIC	STATIC	DYNAMIC
X	Longitudinal		Surge	Heel List	Roll
Y	Vertical		Heave		Yaw
Z	Lateral		Sway	Trim	Pitch

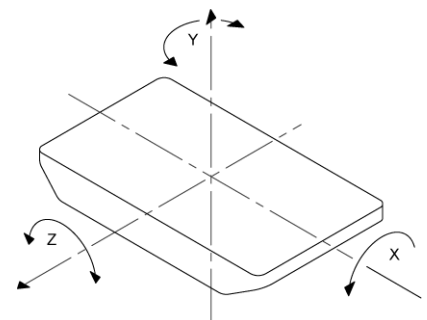


FIGURE 2-11

## Capacity Charts

Manitowoc provides two types of Capacity Charts for a crane mounted on a barge or other supporting structure under static conditions.

1. A Capacity Chart based on tipping when the crane is anchored only to prevent shifting.
2. A Capacity Chart based on structural competence when crane is securely fastened for use as a pedestal mounted crane.

**NOTE:** Unless otherwise specified in a machine list Capacity Chart, a 0 degree machine list Capacity Chart rating applies to machine list **not to exceed 1/2 degree**. All other machine list ratings – 1°, 2°, and 3° – must NOT be exceeded.

## Shock Loading

### Definition

Shock loads to the crane can be experienced when the barge is subjected to up and down movement of wave action (referred to as DYNAMICS). [Figure 2-11](#) illustrates the dynamic conditions of the barge which influence crane capacity.

## CAUTION

### Structural Damage Hazard!

If crane boom or structure is shock loaded during operation, or there is any indication of shock loading, all structural components of crane shall be inspected to detect cracks and other damage. Nondestructive test equipment, such as magnetic particle or ultrasonic procedures, is recommended for this inspection.

**NOTE:** Manitowoc does not recommend crane operation under dynamic conditions.

## Operation On Barge

### General

Machine list and/or dynamics will be experienced when a crane is operated on a barge, ship, or floating platform. Both of these conditions reduce the crane's capacity and each

must be taken into account for safe operation on a barge, ship, or floating platform.



## WARNING

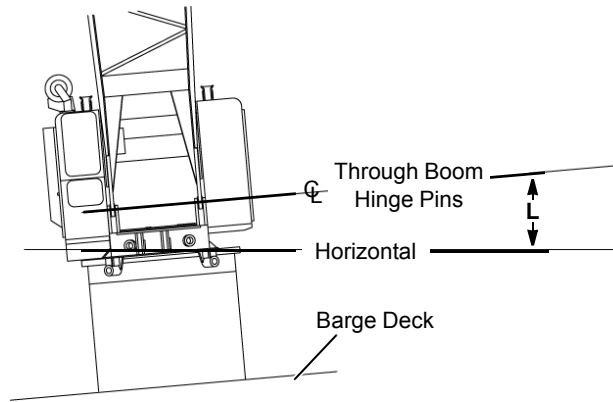
### Tipping Crane Hazard!

Tie-downs which only prevent crane from shifting as in barge, ship or floating platform mounting, may not provide adequate support when using a Capacity Chart for pedestal mounting. Before operating a crane on a barge, ship or floating platform, crane user shall verify that correct Capacity Chart is being used — pedestal mounted, barge mounted, 0°, 1°, 2° or 3° list or dynamic Capacity Chart.

Failing to use correct Capacity Chart can result in an accident.

### Definitions

1. Machine List, as defined by Manitowoc, is the crane's out-of-level condition — from side-to-side — as measured by the angle between horizontal and a line drawn through the centerline of the crane's boom hinge pins ([Figure 2-12](#)). This out-of-level condition creates side load and affects the crane's lifting capacity.
2. Barge List (also referred to as heel or trim) causes swing out of the load and may produce side load. When Manitowoc provides a Capacity Chart showing capacities for a 2 degree machine list for example, we are referring to the maximum allowable lifting capacity for the crane when experiencing an out-of-level condition (side-to-side) of 2 degrees as measured by angle between horizontal and a line drawn through centerline of the crane's boom hinge pins.  
  
Unless otherwise specified in the Capacity Chart, barge list (heel or trim) must not exceed the machine list degrees given in the Capacity Chart.
3. Barge List and Machine List are not same. As the crane rotates on a barge, barge list (as defined above) will change. The worst machine list condition generally occurs when the crane swings over the corner of the barge, producing maximum side load.



L = Degrees of Machine List  
(Maximum allowable is  
specified in Capacity Chart)

FIGURE 2-12

## Crane Inspection

To aid in preventing harmful and damaging failure as previously indicated, regular inspection for signs of overloading in the following load bearing components is required. Correct each defect found before placing the crane into service.

- Boom
- Counterweight

- Backhitch
- Rotating Bed
- Wire Rope
- Pendants and Straps
- Hook and House Rollers

When equipped with hook rollers, it is recommended that each hook roller assembly be inspected daily for any sign of overloading, to include:

- Deformation of roller path
- Proper hook roller adjustment
- Deformation or cracks in hook roller hanger
- Bent hook roller shaft
- Damaged bearings

## Transporting Crane on Barge

If it is necessary to transport the crane on a barge, ship, or floating platform when dynamic conditions will be experienced, the boom must be lowered onto a cradle (or other support) and the crane's boom, rotating bed, and lowerworks must be secured against movement. If the crane is equipped with a mast, the mast must be securely tied down with guylines. Failing to take these steps can result in shock load or side load damage to the boom and mast.

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Reference Only

## SECTION 3

### OPERATING CONTROLS AND PROCEDURES

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**SECTION 3**  
**OPERATING CONTROLS AND PROCEDURES**


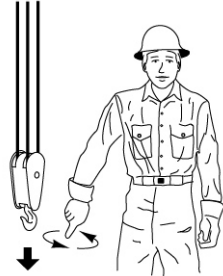
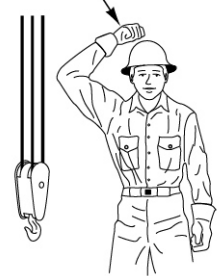
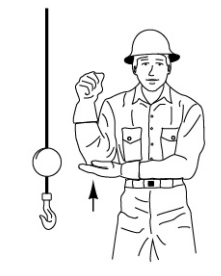
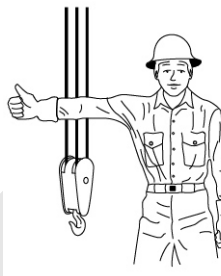

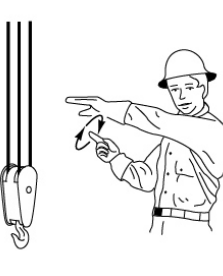

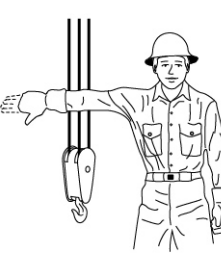
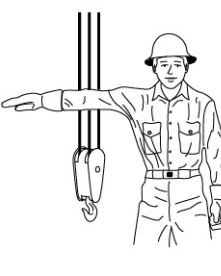

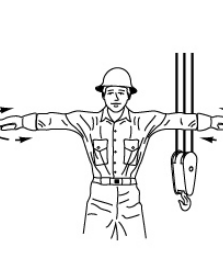
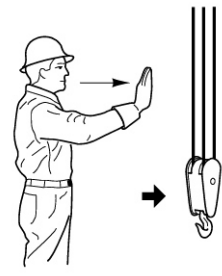
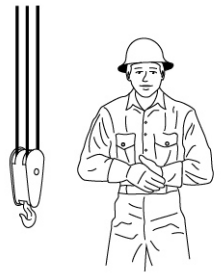
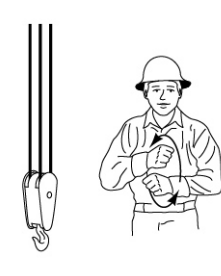

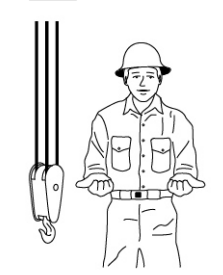
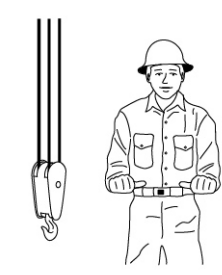


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## STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

The following standard hand signals comply with ASME B30.5-2014.

**Table 3-1 Standard Hand Signals For Controlling Crane Operations**

<p style="text-align: center;"><b>1</b></p>  <p>M100118</p>	<p style="text-align: center;"><b>2</b></p>  <p>M100119</p>	<p style="text-align: center;"><b>3</b></p>  <p>M100120</p>	<p style="text-align: center;"><b>4</b></p>  <p>M100121</p>	<p style="text-align: center;"><b>5</b></p>  <p>M100122</p>
<p style="text-align: center;"><b>6</b></p>  <p>M100123</p>	<p style="text-align: center;"><b>7</b></p>  <p>M100124</p>	<p style="text-align: center;"><b>8</b></p>  <p>M100125</p>	<p style="text-align: center;"><b>9</b></p>  <p>M100126</p>	<p style="text-align: center;"><b>10</b></p>  <p>M100127</p>
<p style="text-align: center;"><b>11</b></p>  <p>M100128</p>	<p style="text-align: center;"><b>12</b></p>  <p>M100129</p>	<p style="text-align: center;"><b>13</b></p>  <p>M100130</p>	<p style="text-align: center;"><b>14</b></p>  <p>M100131</p>	<p style="text-align: center;"><b>15</b></p>  <p>M100132</p>
<p style="text-align: center;"><b>16</b></p>  <p>M100133</p>	<p style="text-align: center;"><b>17</b></p>  <p>M100134</p>	<p style="text-align: center;"><b>18</b></p>  <p>M100135</p>	<p style="text-align: center;"><b>19</b></p>  <p>M100136</p>	<p style="text-align: center;"><b>20</b></p>  <p>M100137</p>

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Item	Description
1	<b>HOIST</b> —With forearm vertical, forefinger pointing up, move hand in small horizontal circles.
2	<b>LOWER</b> —With arm extended downward, forefinger pointing down, move hand in small horizontal circles.
3	<b>USE MAIN HOIST</b> —Tap fist on head. Then use regular signals.
4	<b>USE WHIPLINE (Auxiliary Hoist)</b> —Tap elbow with one hand. Then use regular signals.
5	<b>RAISE BOOM</b> —Arm extended, fingers closed, thumb pointing upward.
6	<b>LOWER BOOM</b> —Arm extended, fingers closed, thumb pointing downward.
7	<b>MOVE SLOWLY</b> —Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (hoist slowly shown as an example).
8	<b>RAISE BOOM &amp; LOWER LOAD</b> —With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.
9	<b>LOWER BOOM &amp; RAISE LOAD</b> —With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.
10	<b>SWING</b> —Arm extended, point with finger in direction of swing of boom.
11	<b>STOP</b> —Arm extended, palm down, move arm back and forth horizontally.
12	<b>EMERGENCY STOP</b> —Both arms extended, palms down, move arms back and forth horizontally.
13	<b>TRAVEL</b> —Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.
14	<b>DOG EVERYTHING</b> —Clasp hands in front of body.
15	<b>TRAVEL (Both Tracks)</b> —Use both fists in front of body, making a circular motion about each other, indicating direction of travel forward or backward. (For Land Cranes Only).
16	<b>TRAVEL (One Track)</b> —Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For Land Cranes Only).
17	<b>EXTEND BOOM (Telescoping Booms)</b> —Both fists in front of body with thumbs pointing outward.
18	<b>RETRACT BOOM (Telescoping Boom)</b> —Both fists in front of body with thumbs pointing toward each other.
19	<b>EXTEND BOOM (Telescoping Boom)</b> —One Hand Signal. One fist in front of chest with thumb tapping chest.
20	<b>RETRACT BOOM (Telescoping Boom)</b> —One hand signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

### SYMBOL IDENTIFICATION

The following symbols are used on the cab and remote control consoles:

Alert, Safety		Drum	
Cab Tilt		Drum – Lower (Load, Boom, Luffing Jib, or Mast) (depends on drum use.)	
Cylinders, Jacking – Extend or Retract		Drum – Raise (Load, Boom, Luffing Jib, or Mast) (depends on drum use.)	
Cylinders, Jacking – Location	<p><i>Left Front</i> </p> <p><i>Right Front</i> </p> <p><i>Left Rear</i> </p> <p><i>Right Rear</i> </p> <p><i>All</i> </p>	Drum Free Fall (with drum number)	
Cylinders, Live Mast– Extend or Retract		Drum Number (identifies drum is in use)	
Cylinders – Live Mast			

FIGURE 3-1

Energize (turn on)	
Coolant Temperature	
Engine, Battery Voltage	
Engine, Fuel	
Engine Oil Pressure	
Engine Run	
Engine Start	
Engine Stop	
Engine	
Exhaust Aftertreatment	
Manual Regeneration	
Auto Regeneration Inhibit	






Heater/Defroster	
Horn	
Light, Panel	
Light, Dome	
Lighter	

FIGURE 3-1 continued


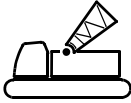












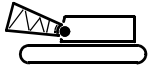

On/Start and Off/Stop		Pins – Main Mast	
Off/Stop		Pins – Rotating Bed Front	
On/Start		Pins – Rotating Bed Rear	
Park Off		Scroll up/Scroll down	
Park		Setup Mode	
Pins – Disengage		Speed, Fast	
Pins – Engage		Speed, Slow	
Pins – Boom Hinge		Stop (emergency)	

FIGURE 3-1 continued

Swing		Travel Direction Reverse – Right Crawler	
Swing Left		Travel Speed	
Swing Right		Winch, Rigging	
Travel		Winch, Rigging– Haul In Rope	
Travel Cruise		Winch, Rigging – Pay Out Rope	
Travel Direction Forward – Left Crawler		Windshield Wiper – Overhead with Washer	
Travel Direction Forward – Right Crawler		Windshield Wiper – Front with Washer	
Travel Direction Reverse – Left Crawler			

3

FIGURE 3-1 continued

## OPERATING CONTROLS

### General

The purpose of the following instructions is to familiarize qualified operators with the location and function of the operating controls for this crane. This section also contains safety information and a description of operation for each crane function.

Depending on the options your crane is equipped with, some controls identified in this section will not apply.



### WARNING

#### Death or Serious Injury!

To prevent death or serious personal injury, use the following precautions:

- Read and thoroughly understand the instructions in this section, section 2, and the Capacity Chart Manual.
- Contact your Manitowoc dealer for assistance if you do not clearly understand any operating procedure.

### Front Window

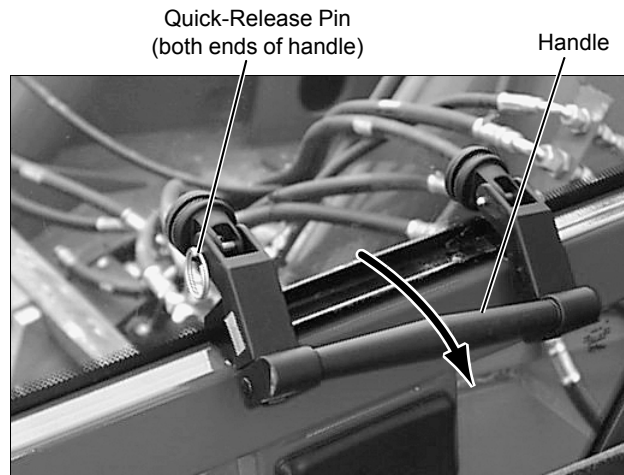
To close the window, rotate the window handle down to the position shown in [Figure 3-2](#), View A.

To open the window, rotate the window handle up to the position shown in [Figure 3-2](#), View B. The window can swing open approximately 76 mm (3 in) for ventilation.

### Opening Window for Emergency Exit

To open the window for emergency exit, use the following:

1. Pull out both quick-release pins at the handle.
2. Remove both knobs at the top of the window ([Figure 3-2](#), View C).
3. Push the window out and exit the cab.



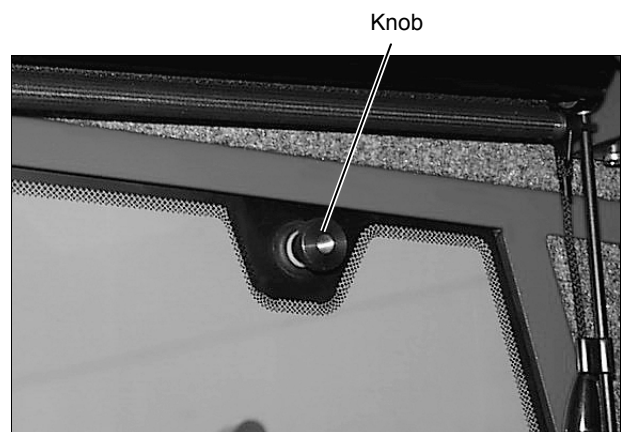
P1751

View A



P1750

View B



P1752

View C

(2 places at top of window)

FIGURE 3-2



### Cab Door Damper

The cab door damper prevents the cab door from slamming open or closed. This is critical when the cab is tilted at an angle other than horizontal.

#### Closing Cab Door

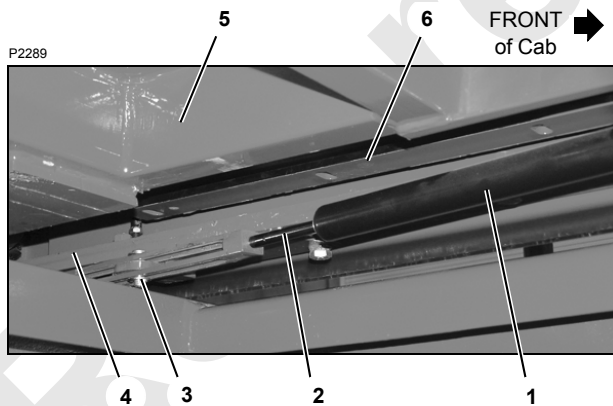
To close the cab door, use the following:

1. Slide the cab door to the closed position, **but don't latch it**. This releases hydraulic pressure in the damper.
2. Open the cab door approximately 20 cm (8 in).
3. Slide the cab door fully closed and latch it.

#### Damper Adjustment

To adjust the damper, use the following:

1. Adjust cab tilt to the level position.
2. Remove the pin (3, [Figure 3-3](#)).
3. Swing the damper with the rod end away from the door.
4. Pull the piston rod out to the fully extended position:
  - a. While pulling on the rod, turn it clockwise (looking at rod end) approximately four full turns until it stops. This is the maximum damper pressure setting.
  - b. While pulling on the rod, turn it counterclockwise (looking at rod end) approximately four full turns from the maximum to the minimum damper pressure setting. This is the recommended pressure setting.
5. Reconnect the rod end to the cab door.
6. If desired, repeat the adjustment to obtain the desired damping.



Item	Description
1	Damper
2	Piston Rod
3	Pin with Washers and Cotter Pins
4	Rod End
5	Bottom of Cab
6	Bottom of Sliding Door

FIGURE 3-3

### Engine Clutch Lever

Pull the clutch lever ([Figure 3-4](#)) out and push it down to disengage the clutch.

Pull the clutch lever up and push it in to engage the clutch.

### Battery Disconnect Switch

#### CAUTION Engine Damage!

To avoid possible engine fault codes and undesirable operation, make sure the engine ignition switch has been off five minutes before disconnecting the batteries.

Do not rely on this switch to protect the crane's electronic systems when welding. Disconnect the battery cables at the batteries before welding.

Turn the battery disconnect switch ([Figure 3-4](#)) clockwise to connect the battery circuit.

Turn the battery disconnect switch counterclockwise to disconnect the battery circuit for the following reasons:

- To service the crane's electrical control system
- If desired, to prevent the batteries from discharging when the crane is stored for extended periods
- If desired, to prevent unauthorized personnel from starting the crane

To keep unauthorized personnel from connecting the battery and starting the crane, remove the handle from the battery disconnect switch.



Right Side of Crane  
Clutch Lever Shown in Engaged Position  
Battery Disconnect Switch Shown in Connected (Closed) Position

FIGURE 3-4

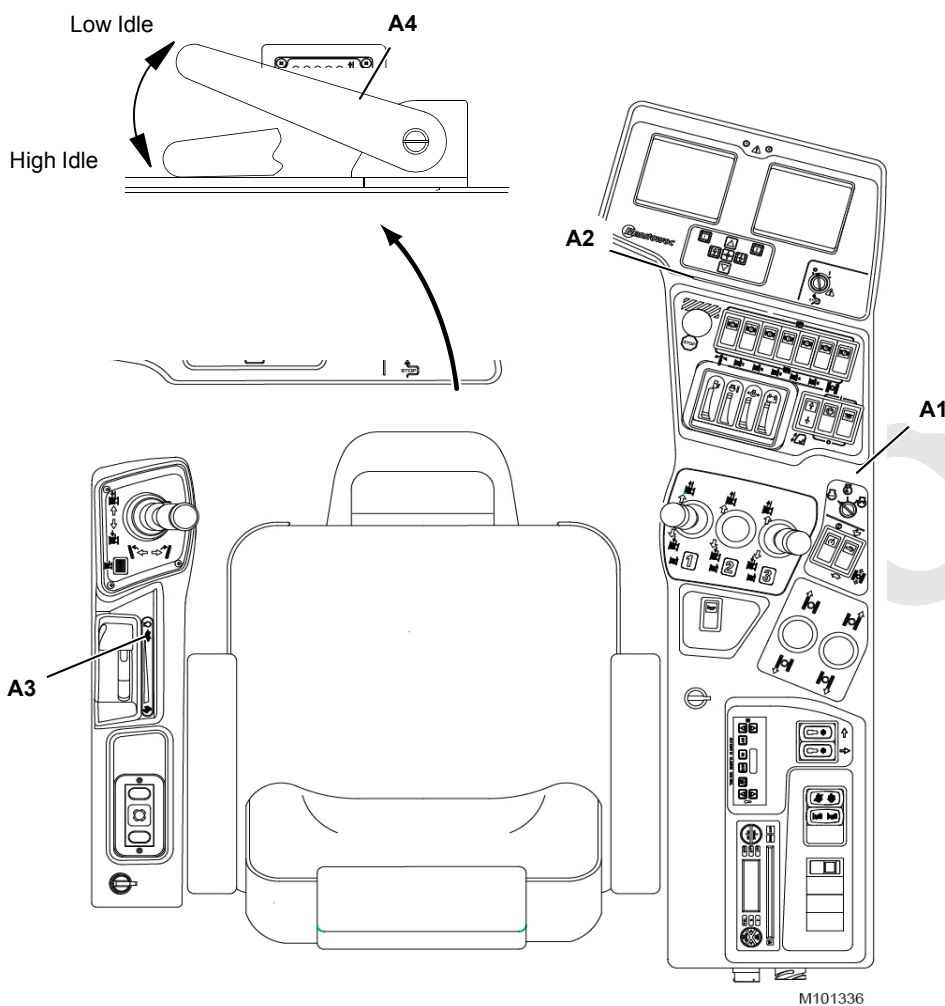


FIGURE 3-5

## CONTROLS IDENTIFICATION AND FUNCTION



### WARNING

#### Unauthorized Startup!

Always stop the engine and remove the key before leaving the crane unattended. This practice will prevent unauthorized personnel from operating the crane.

## A – Engine Controls

See [Figure 3-5](#) for engine controls.

### A1. Engine Ignition Switch

To turn on the engine ignition switch, use the following:

1. Insert the key.
2. Turn the key clockwise to the run position to activate the crane's electric circuits.
3. Turn the key fully clockwise to start the engine. **Release the key to the run position as soon as the engine starts.**
4. Rotate the key counterclockwise to stop the engine and turn off the crane's electric system.

**NOTE** Engine diagnostic faults appear on the engine screen (see [Displays](#) topic in this section) when the ignition is in the run position. The faults must go away when the engine starts. See the engine manufacturer operating instructions manual for engine diagnostic information.

## A2. Engine Emergency Stop Switch

### CAUTION Engine Damage!

Press the emergency stop switch only in an emergency. When the switch is pressed, the engine stops, the brakes apply, and any **operating functions come to an abrupt stop**.

In an emergency, push the emergency stop switch down to stop the engine (for example, if a crane function does not stop when the control handle is released or if a crane function is uncontrolled).

**NOTE** The switch must be pulled up before the engine can be restarted.

If the emergency stop switch has been pressed, test all disc brakes for proper operation before putting the crane back in service. See Section 2 of Service Manual for procedure.

Use the engine ignition switch (A1) to stop the engine for normal operating conditions.

## A3. Engine Hand Throttle

Pull the handle back to increase engine speed.

Push the handle forward to decrease engine speed.

**NOTE:** The engine maintains the current speed when the handle is released.

The speed of a crane function depends on engine speed and how far the function control handle is moved from the OFF position.

Engine speed must be fast enough to provide enough power for the work being done. **The engine can stall under load if the engine speed is too slow.**

## A4. Engine Foot Throttle

Press the foot throttle to increase engine speed above the hand throttle setting.

Release the foot throttle to decrease engine speed to idle or back to the hand throttle setting.

**NOTE:** When the engine speed switch on either remote control (setup or MAX-ER) is in the high speed position, the cab throttle controls cannot decrease engine speed below approximately 1,500 rpm.

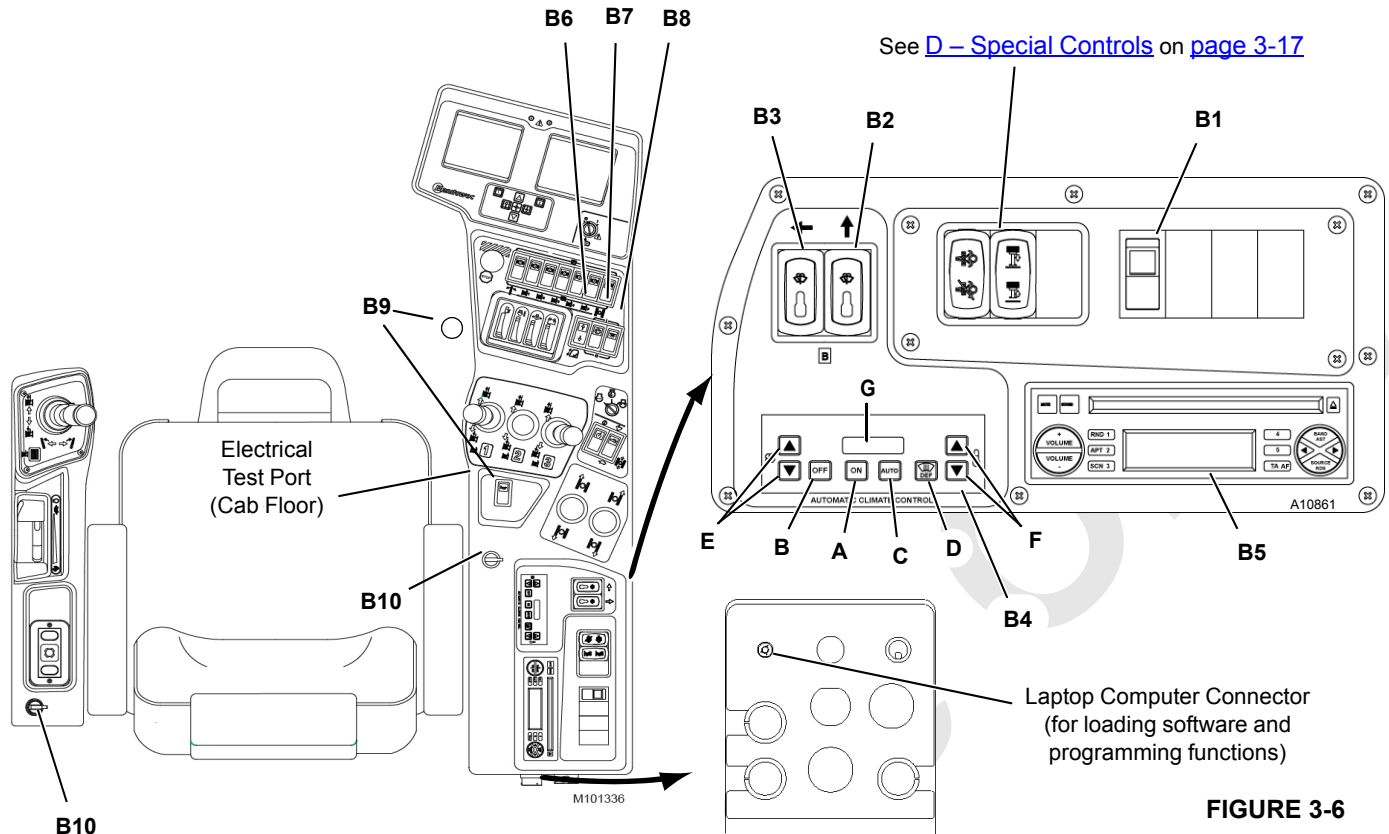


FIGURE 3-6

**B – Accessory Controls**

See [Figure 3-6](#) for accessory controls.

**B1. Crane Work or Drum Lights Switch (Optional)**

The crane work or drum lights switch controls four optional lights mounted on the cab, rotating bed, and boom butt.

Press the top of the rocker to turn the lights on.

Press the bottom of the rocker to turn the lights off.

**B2. Overhead Windshield Wiper Switch**

**B3. Front Windshield Wiper-Washer Switch**

When the switch is fully down, the wiper is off.

When the switch is fully up, the wiper is on at high speed.

When the switch is partly up, the wiper is intermittent. The rate increases as the switch moves toward fully up:

Press the top end of the front windshield wiper switch to spray washer fluid onto the front window.

**NOTE:** The windshield washer tank is mounted at the rear of the cab support. Fill the tank with a quality brand washing solution that **will not freeze during cold weather**.

**B4. Climate Control**

Climate control provides cab temperature control from 13 to 35°C (55 to 95°F). The follow functions are included for climate control:

- A. ON**—Press to turn the climate control system on. The LED will illuminate and display the current temperature setting.
- B. OFF**—Press to turn the climate control system off.
- C. AUTO**—Press to place the system in fully automatic temperature control mode, including fan speed. The system will adjust the blower fan speed to the lowest setting necessary to maintain the selected cab temperature. A panel indicator light illuminates when this mode is on.
- D. DEF (defrost)**—Press to energize the A/C system to quickly de-humidify the cab. A panel indicator light illuminates when this mode is on.
- E. FAN UP/DOWN**—Overrides the AUTO mode. Press to raise or lower fan speed between 11 speeds. The LED indicates the setting as a percent between hi and lo. The system maintains the selected fan speed until the FAN UP/DOWN setting changes or the AUTO mode is turned on.

- F. **TEMPERATURE UP/DOWN**—Press to raise or lower the temperature setting. The system maintains the cab temperature as close as possible to the temperature setting.

To change the display temperature between Fahrenheit and Celsius, Press the temperature up and temperature down buttons simultaneously.

- G. **FAULT CODE DISPLAY**—Displays climate control fault codes. To display codes, press the on button three times. The display shows active fault codes. Potential fault codes include the following:

- E00 — No Faults
- E01 — Cab Sensor Shorted
- E02 — Cab Sensor Open
- E03 — Evaporator Probe Shorted
- E04 — Evaporator Probe Open
- E09 — Water Valve Shorted
- E10 — Water Valve Open

#### **B5. Radio/CD Player (optional)**

See manufacturer instructions.

#### **B6. Cab Tilt Switch**



#### **WARNING**

#### **Moving Cab Hazard!**

Warn personnel to stand clear of the operator cab while tilting:

- Personnel can lose balance and fall
- Personnel can be crushed between the cab and railing

Press and hold the top of the rocker to raise the front of the cab.

Press and hold the bottom of the rocker to lower the front of the cab.

Release the rocker to the center to lock the cab in position.

#### **B7. Panel Lights Switch**

Press the top of the rocker to turn the panel lights on.

Press the bottom of the rocker to turn the panel lights off.

#### **B8. Dome Light Switch**

Press the top of the rocker to turn the dome light on.

Press the bottom of the rocker to turn the dome light off.

#### **B9. Horn Switches**

**To warn personnel while the crane is in operation or service**, use one of two horn switches: one on the right console and one on the cab floor.

On the right console, press and hold the bottom of rocker to turn the horn on. Release the rocker to turn the horn off.

On the cab floor, press and hold the switch with the right foot to turn the horn on. Release the switch to turn the horn off.

#### **B10. 12 Volt Power Supply Receptacles**

Power supply receptacles can operate or charge an appliance.

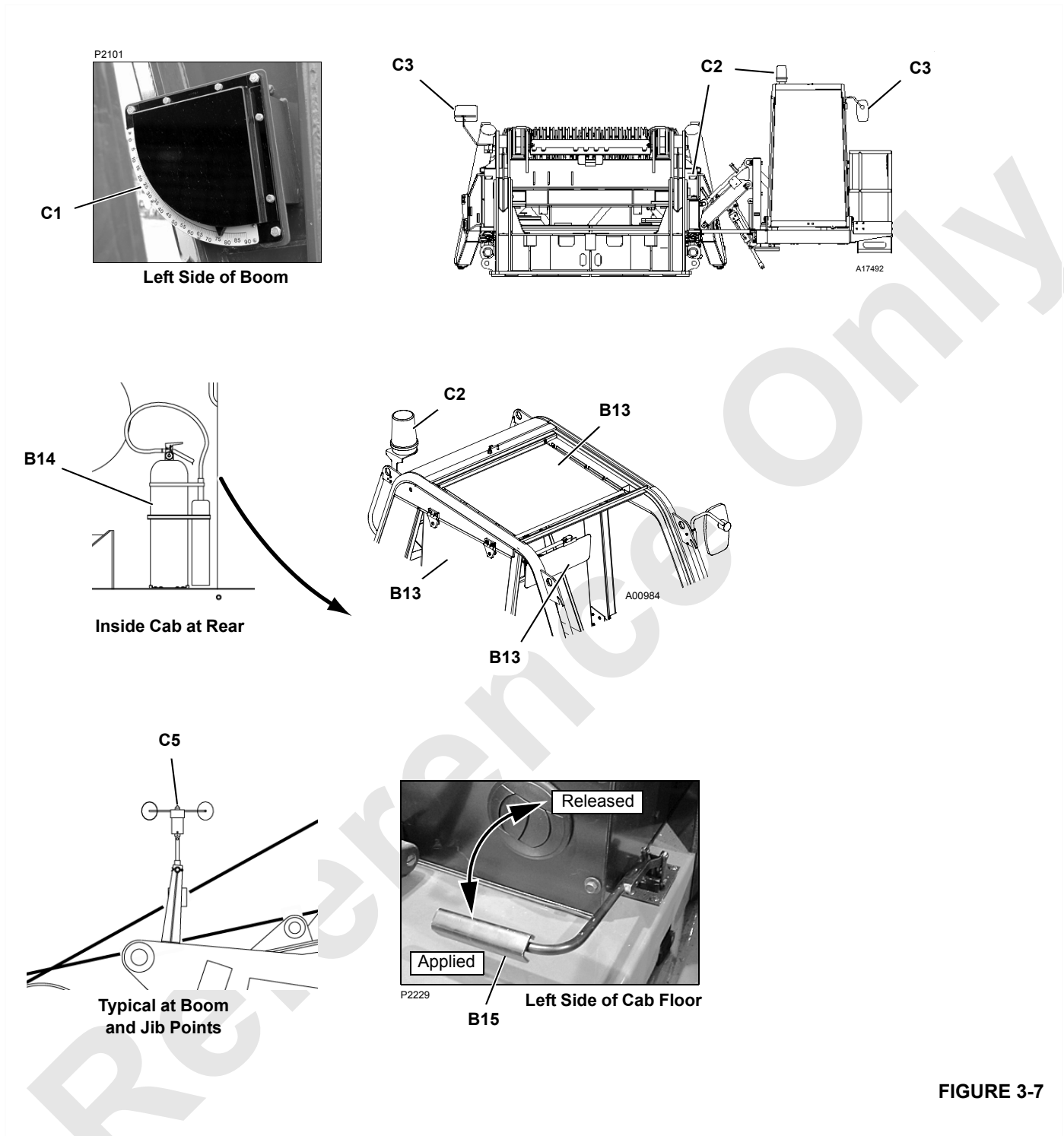


FIGURE 3-7

See [Figure 3-7](#) for these accessory controls.

**B13. Tinted Visor and Shade**

A visor on the front window and shades on the roof and side windows shade the cab from sunlight. Position the visor and shades as desired.

**B14. Fire Extinguisher**

The cab contains one fire extinguisher behind the seat. Foreign code requires another fire extinguisher mounted on the crane.

**B15. Cab Door Brake**

The cab door brake locks the cab door in any position. Push the handle down to apply the brake, and pull the handle up to release the brake.

**C – Indicators**

See [Figure 3-7](#)

**C1. Boom Angle Indicator**

The boom angle indicator shows the boom angle in degrees above horizontal. The RCL display or main display also show the boom, luffing jib, and mast angles.

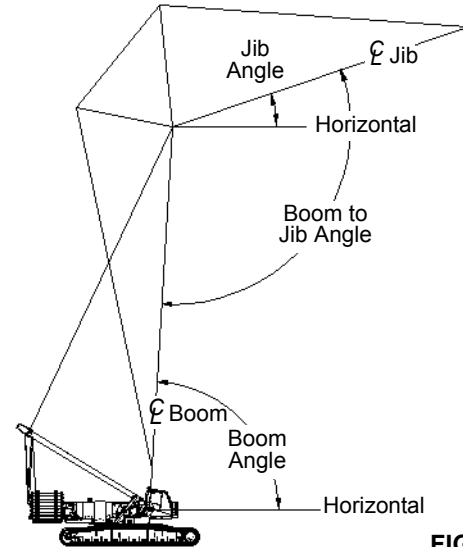
See [Figure 3-8](#) for identification of the various boom and luffing jib angles.

**WARNING****Overload Hazard!**

Use the boom angle indicator only as a guide to position the boom near an angle corresponding to the radius for a given load.

In all cases, the radius must govern capacity. Exceeding the radius given in the capacity chart can result in tipping or structural damage.

A1298

**FIGURE 3-8****C2. RCL Alarm (optional)**

The RCL alarm indicates the crane capacity is near an overload condition when the RCL system is on. An amber beacon rotates and an alarm sounds when the crane is near an overload condition.

**C3. Rear View Mirrors**

Adjustable rear view mirrors on the cab and right side of the rotating bed provide a view of the rear of crane. Mirrors can rotate inward for shipping.

**C5. Wind Speed Transmitter**

Wind speed at the boom and jib points appears in the wind speed screen (see [Displays](#) topic).

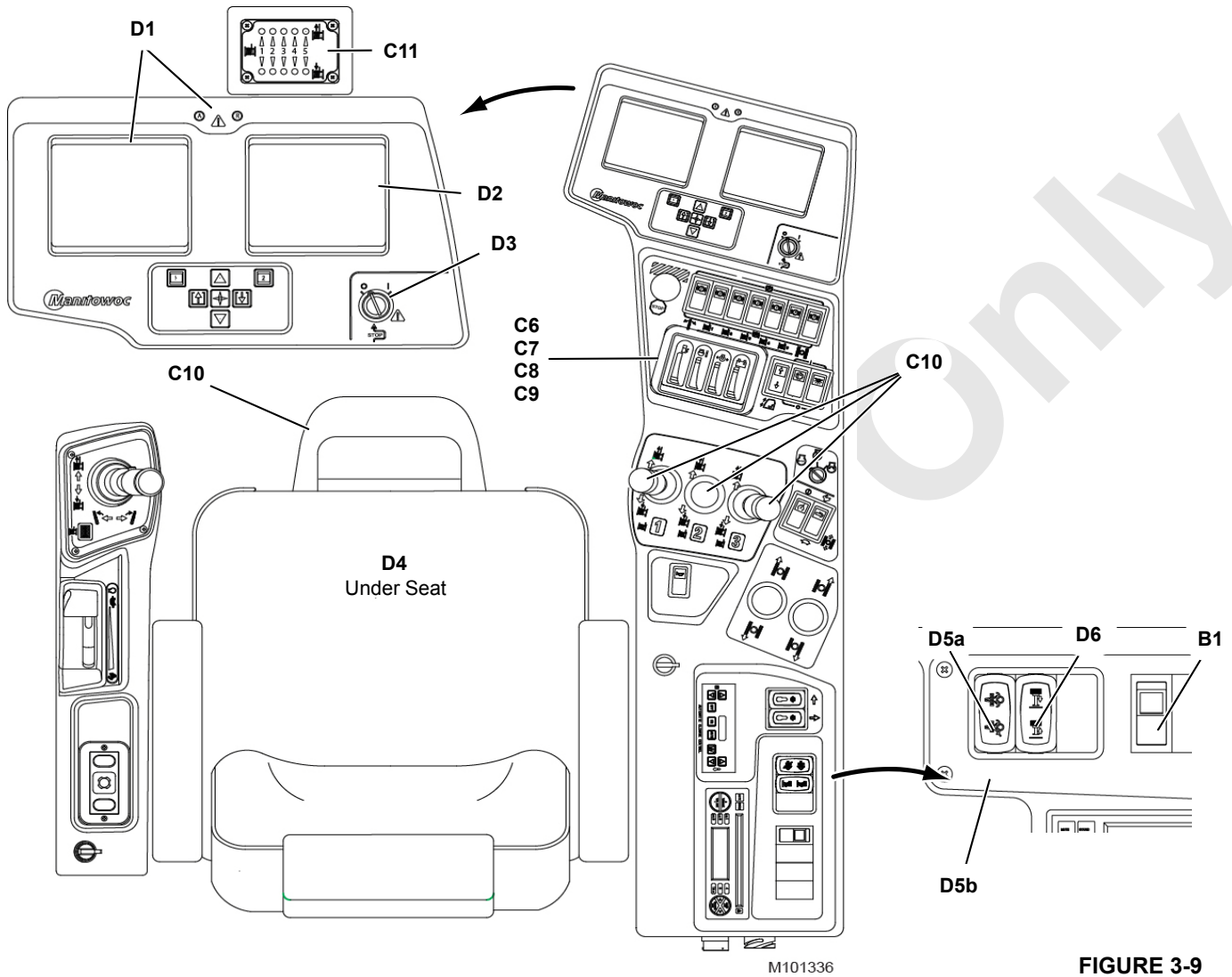


FIGURE 3-9

See [Figure 3-9](#) for following indicators.

**C6. Fuel Level**

A bar graph display shows the amount of fuel remaining in the fuel tank.

**C7. Engine Coolant Temperature**

A bar graph display shows the engine coolant temperature.

**C8. Engine Oil Pressure**

A bar graph display shows the engine oil pressure.

**C9. Battery Voltage**

A bar graph display shows the battery voltage.

**C10. Drum Rotation Indicators**

Pin-type actuators, located under all drum handle covers, move up and down to signal, by feel, that the corresponding drum is turning. Indicator movement corresponds to drum speed.

**C11. Drum Direction Indicators**

Glow green to indicate the direction in which a drum is being operated.



## D – Special Controls

See [Figure 3-9](#) for special controls.

### D1. RCL Display and Indicator Lights

The RCL display shows load lifting information and alerts of overload conditions. See the separate Rated Capacity Indicator/Limiter Operation manual for detailed instructions.

### D2. Main Display

The main display shows operating conditions, faults, and diagnostic information. See the [Displays](#) topic for detailed instructions.

### D3. Limit Bypass Switch



#### WARNING

When bypassing a limit, carefully follow the instructions under the [Limit Devices](#) topic.

The limit bypass switch deactivates the limits identified in [Table 3-2](#).

To use the switch, insert the key. Turn the key clockwise and hold it to allow operation beyond the limits.

Release the key to re-activate the operating limits. In this position, the limits stop the functions as normal.

Remove the key to prevent unauthorized operation.

### D4. Seat Switch

The seat switch prevents the crane from operating if the seat is empty. When nobody is seated, all control handles are inoperable, all brakes are applied, and travel cruise is off.

### D5. Exhaust System Manual Regeneration/Inhibit Switch

The manual regeneration inhibit switch is a three-position rocker switch. The top position is momentary. The center and bottom positions are maintained. For more information on this switch, see [Engine Faults and Information](#) on [page 3-46](#) and Section 7 of the Service Manual.

#### Active Position

The active center position is for the normal engine operation. The active position does not require operator assistance under normal conditions. This position allows the exhaust system to actively (automatically) regenerate.

#### a. Manual Regeneration

If the Engine Information screen indicates the exhaust system requires a manual regeneration (see [Engine Faults](#)

[and Information](#) on [page 3-46](#)), press and release the top of the rocker switch(D5a). The Cummins ECM will control a regeneration cycle.

The top of the rocker switch is momentary and the switch will return to the active position after the top of the switch is pressed.

A manual regeneration will begin only if the following conditions are met:

- The engine is at low idle
- The accelerator pedal is not pressed

**NOTE:** A guard over the switch prevents accidental manual regeneration.

The High Exhaust System Temperature (HEST) lamp may come on during regeneration and remain on for a short time after regeneration.

#### b. Regeneration Inhibit

#### CAUTION

#### Possible Exhaust System Damage or Engine Shutdown!

Only use the Inhibit switch for special circumstances where it is desirable to disable active regeneration. Prolonged engine operation with regeneration inhibited may damage the exhaust system or cause loss of engine power or engine shutdown by the ECM.

To prevent the exhaust system active (automatic) regeneration, press the bottom of the rocker switch (D5b). The switch will remain depressed. The amber LED in the rocker will glow. To re-enable active regeneration, manually return the switch to the active position.

Do not use the Inhibit switch unless specifically instructed by a Manitowoc or Cummins technical advisor.

The exhaust system regen inhibited icon (see Exhaust System Regen Inhibited on [page 3-46](#)) indicates the aftertreatment system active (automatic) regeneration is prevented because the inhibit switch is in the inhibit position.

For information on exhaust system-related faults, see [Engine Faults and Information](#) on [page 3-46](#).

See the Cummins Owners Manual for information on the after treatment system and engine faults.

### D6. BRS Jack Extend/Retract Switch (Optional)

Refer to the separate Boom Raising System Manual for detailed operating instructions.

Table 3-2 Bypassable Limit Identification

Limit <sup>5</sup>	Limit Bypass Switch		Limit Bypass Switch Luffing Jib Setup Mode <sup>1</sup>		External Override Switch <sup>2</sup>
	Non-CE	CE <sup>3</sup>	Non-CE	CE <sup>3</sup>	CE <sup>3</sup>
Boom Maximum Up [55]	No	No	No	No	No
Block Up (each drum) [60]	No	No	No	No	No
Minimum Bail (each drum) [57]	No	No	No	No	No
Luffing Jib Maximum Up 1 [49]	No	No	No	No	No
Luffing Jib Maximum Up 2 [73]	No	No	No	No	No
Luffing Jib Maximum Down 1 [50]	No	No	No	No	No
Luffing Jib Maximum Down 2 [67]	No	No	No	No	No
Mast Too Far Forward [66]	No	No	No	No	No
Rated Capacity Indicator/Limiter [54]	No	No	No	No	Yes <sup>4</sup>
MAX-ER Limits	No	No	No	No	No

<sup>1</sup> Use only for rigging. See [Luffing Jib Setup Mode](#) on [page 3-19](#).

<sup>2</sup> See Rated Capacity Indicator/Limiter Operation Manual.

<sup>3</sup> CE - Cranes that comply with 2010 European requirements (see NOTE below).

<sup>4</sup> Allows up to 30 minutes of bypass operation.

<sup>5</sup> Numbers in brackets [ ] are fault codes. See [Table 3-3](#) starting on [page 3-48](#).

**NOTE:** Cranes meeting 2010 European requirements are equipped with an RCI/RCL External Override Switch located outside the cab (see Rated Capacity Indicator/Limiter Operation Manual).

### LUFFING JIB SETUP MODE

The luffing jib must be in setup mode before bypassing the limits in the center two columns of [Table 3-2](#):

1. Enter the function mode screen in the main display ([Figure 3-10](#)).

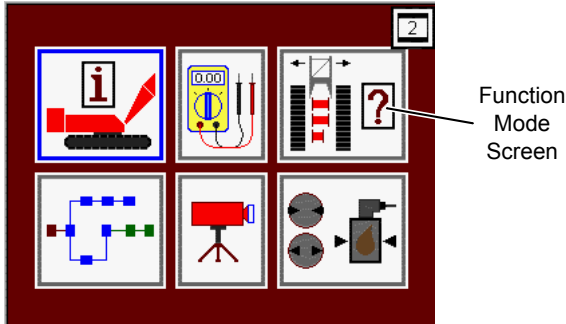


FIGURE 3-10

2. Select the setup screen ([Figure 3-11](#)). The screen shown in [Figure 3-12](#) will appear.

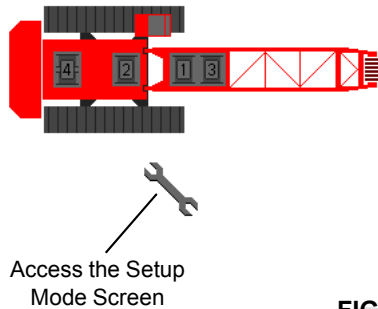


FIGURE 3-11

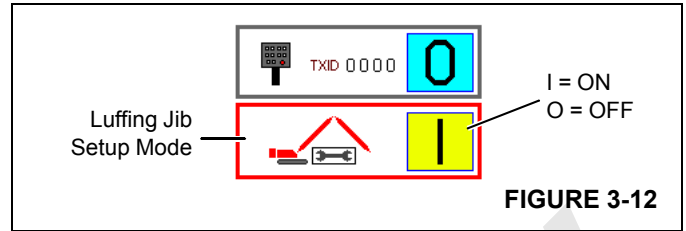


FIGURE 3-12

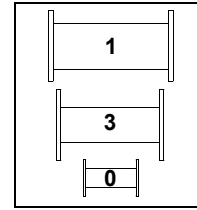
3. Turn the luffing jib setup mode on (or off when done with luffing jib setup).
4. Rotate the limit bypass switch clockwise and release it. The limits will remain bypassed for 10 seconds unless a control handle is moved.
5. Move the desired control handle (luffing hoist, boom hoist, load drum) in the required direction. The limits will remain bypassed for as long as the handle is moved in either direction.
6. The limits will remain bypassed for 10 seconds after the control handle is returned to off.

To turn setup mode off, repeat steps 1 to 3.

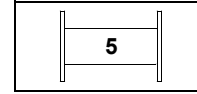
**NOTE:** When the luffing jib setup mode is on, the crane setup fault is turned on and the alarm in the cab sounds intermittently.

Drum and Handle Identification

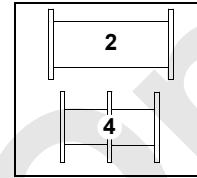
Drum No.	Description
0	Rigging Winch (in boom butt)
1	Load Drum (in boom butt)
2	Load Drum
3	Load/Luffing Drum (in boom butt)
4	Boom/Mast Hoist
5	Boom Hoist - with MAX-ER (in mast butt)



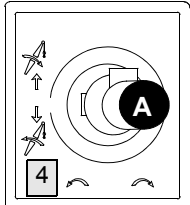
Boom Butt



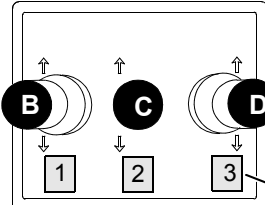
Mast with MAX-ER only



Crane



Left Console



Right Console

Handle Display Lights (4)

Handle Options (Note 1)	HANDLE A Controls Drum	HANDLE B Controls Drum	HANDLE C Controls Drum	HANDLE D Controls Drum
Standard	4 - Boom Hoist	1 - Load Hoist	2 - Load Hoist	3 - Load Hoist
Rigging Winch	0 - Rigging Winch	1 - Load Hoist	2 - Load Hoist	3 - Load Hoist
Luffing Jib (Note 2)	3 - Luffing Hoist	1 - Load Hoist	2 - Load Hoist	4 - Boom Hoist
MAX-ER Setup	4 - Mast Hoist	1 - Load Hoist	2 - Load Hoist	5 - Boom Hoist
MAX-ER (Note 3)	5 - Boom Hoist	1 - Load Hoist	2 - Load Hoist	3 - Load Hoist
MAX-ER w/Luffing Jib (Note 3)	3 - Luffing Hoist	1 - Load Hoist	2 - Load Hoist	5 - Boom Hoist

**NOTE 1:** Handle display lights show which drums are controlled by which handles.

**NOTE 2:** Load/Luffing hoist (drum 3) and left travel are both controlled by same pump. Only one system can be operated at a time.

**NOTE 3:** In MAX-ER configuration, boom hoist (drum 5) is operable and mast hoist (drum 4) is inoperable.

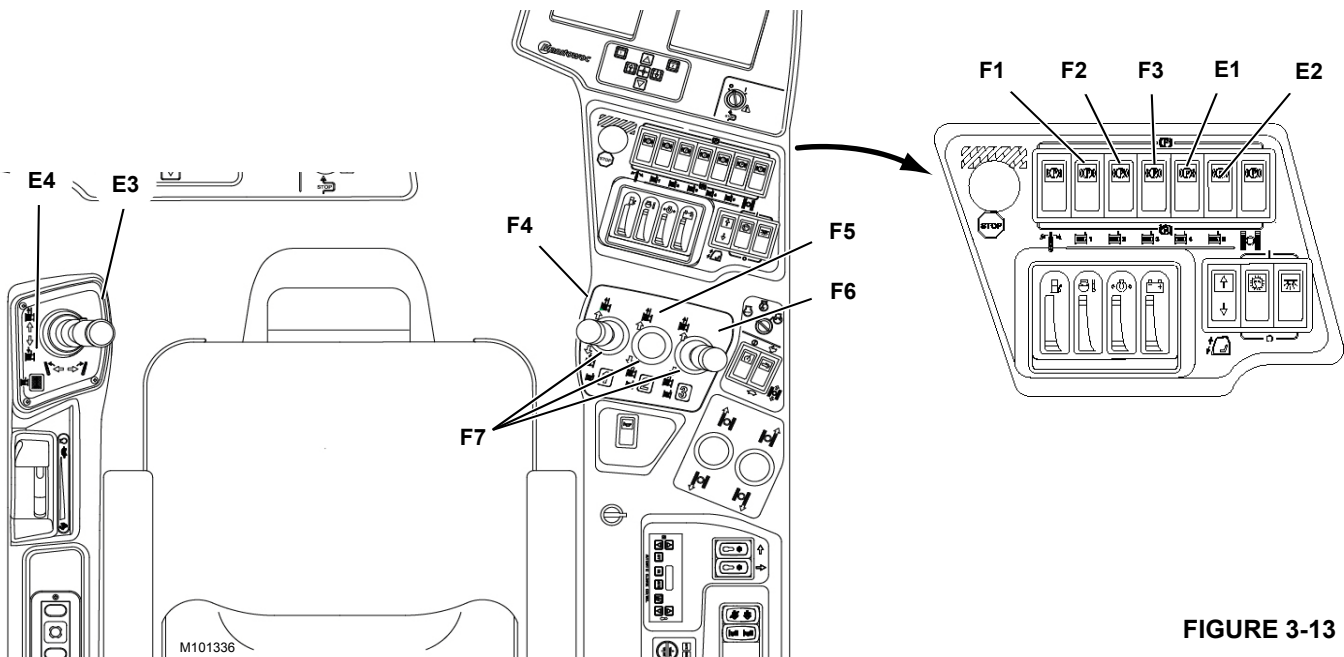


FIGURE 3-13

See [Figure 3-13](#) for drum and handle identification.

## E – Boom/Mast Hoist Controls

The boom/mast hoist and swing are controlled by a dual-axis handle that allows control of both functions at the same time with one handle.

The boom/mast hoist has a spring-applied, hydraulically-released disc brake on one motor of the drum:

- The drum brake releases automatically when the handle is moved in either direction from off.
- The drum brake applies automatically when the handle is in the off position, the engine is stopped, power is lost, the machine reaches applicable operating limits, the system detects a system fault, or the selected park switch is turned on.

### E1. Drum 4 (Boom/Mast Hoist) Park Switch

### E2. Drum 5 (Boom Hoist) Park Switch

Press the top of the rocker to turn the park switch on. With the park switch on, the boom/mast hoist handle is inoperable, the drum brake applies, and the drum pawl engages.

Press the bottom of the rocker to turn the park switch off. With the park switch off, the boom/mast hoist handle is operable, the drum brake applies in conjunction with handle movement, and the drum pawl disengages.

### E3. Drum 4 or 5 (Boom/Mast Hoist) Handle

Pull the handle back to raise the boom. The drum brake will release and speed will increase in relation to handle movement.

Push the handle forward to lower the boom. The drum brake will release and speed will increase in relation to handle movement.

Release the handle to center to stop the boom. The drum brake spring will apply.

**NOTE:** When the crane is configured with a luffing jib, the boom/mast hoist handle D is the last load drum handle on right console. Handle A then controls the luffing jib.

### E4. Drum Indicator

The drum indicator displays the drum number to indicate that boom/mast hoist is active.

## F – Load Drum Controls

Each load drum has a spring-applied, hydraulically-released disc brake on motor at one end of drum:

- When a drum handle is moved from off, the corresponding drum brake releases automatically.
- When a drum handle is moved back to off, the corresponding drum brake applies automatically.

**NOTE:** Drum brakes apply automatically when the engine is stopped, power is lost for any reason, the machine reaches applicable operating limits, the system detects a system fault, or the drum park switch is turned on.

### F1. Drum 1 Park Switch

### F2. Drum 2 Park Switch

### F3. Drum 3 Park Switch

Press the top of the rocker to turn the corresponding drum park switch on. With the drum park switch on, the drum handle is inoperable, the drum brake applies, and (if equipped) the drum pawl engages.

Press the bottom of the rocker to turn the drum park switch off. With drum park off, the drum handle is operable, the drum brake releases in conjunction with handle movement, and (if equipped) the drum pawl disengages.

### F4. Drum 1 Handle

### F5. Drum 2 Handle

### F6. Drum 3 Handle

Pull the handle back to hoist the load. The drum brake will release and speed will increase in relation to handle movement.

Push the handle forward to lower the load. The drum brake will release and speed will increase in relation to handle movement.

Release the handle to center to stop the load. The drum brake spring will apply.

### F7. Drum Indicator

The drum indicator displays the number of the drum the corresponding handle will control. Drum operation can vary depending on crane configuration. See [Figure 3-13](#) for drum and handle identification.

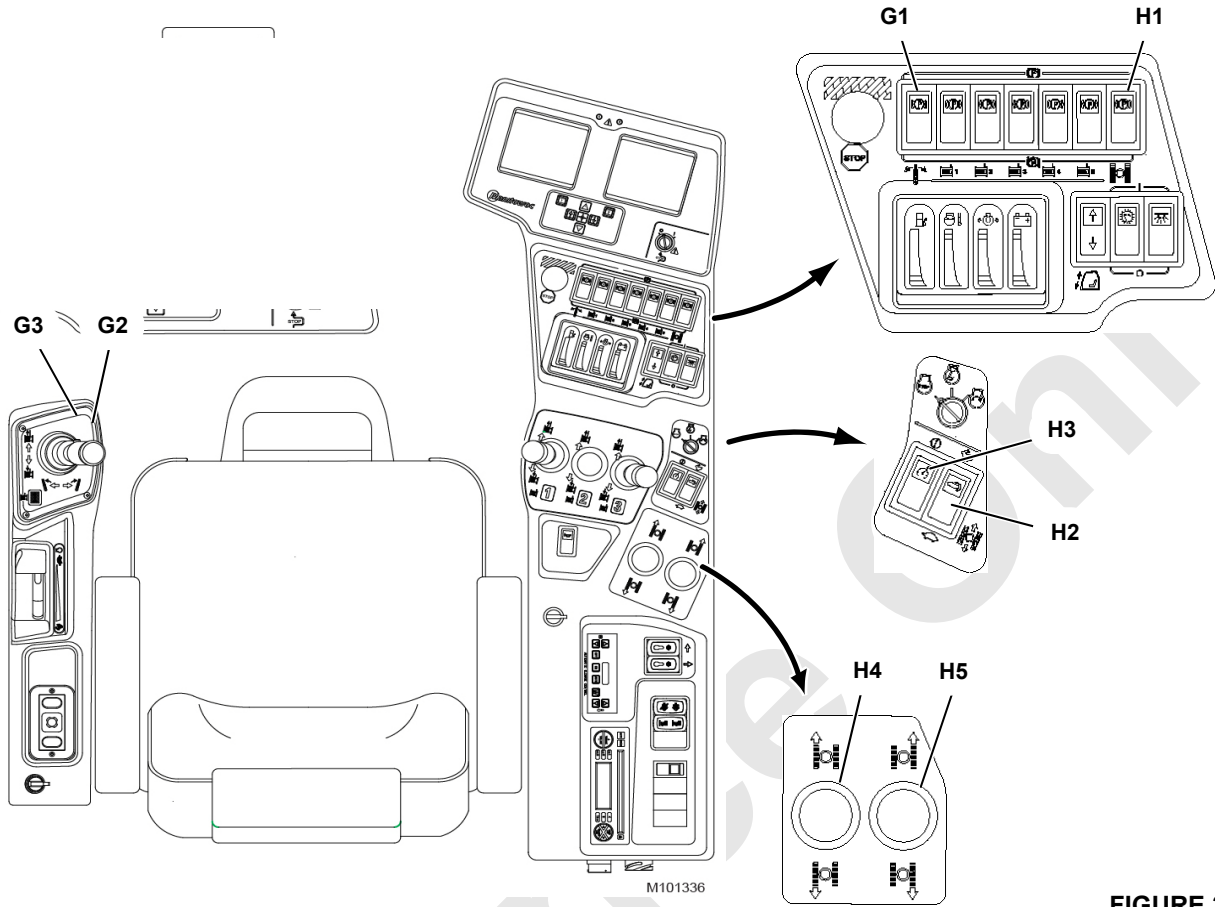


FIGURE 3-14

**G – Swing Controls**

See [Figure 3-14](#) for swing controls.

The swing drive has a spring-applied, hydraulically-released disc brake:

- During normal operation, the brake is released and the lock is disengaged.
- The brake applies automatically if power is lost, the swing holding brake switch is enabled, or the drum park switch is turned on.

**G1. Swing Park Switch**

Press the top of the rocker to turn the swing park switch on. With the park switch on, the swing handle is inoperable and the swing brake applies.

Press the bottom of the rocker to turn the swing park switch off. With the park switch off, the swing handle is operable and the swing brake releases.

**G2. Swing Handle**

A dual-axis handle controls the boom/mast hoist and swing at the same time with one handle. The swing alarm will beep to warn personnel when the rotating bed is swinging.

Move the handle left to swing left. Move the handle right to swing right. Swing speed increases in relation to handle movement.

Release the handle to center to stop. Swing speed decreases to off and the rotating bed slows to a stop. Move the handle in the opposite swing direction to stop the swing motion faster.

Press the swing holding brake switch to hold the stopped rotating bed in position.

### G3. Swing Holding Brake Switch

#### CAUTION

##### Swing Drive/Boom Damage!

Do not apply the swing holding brake or turn on the swing park switch while swinging. The brake will bring the rotating bed to an abrupt stop, which could cause damage to the boom from side loading or damage to the swing drive from shock loading. Bring the rotating bed to a smooth stop using the swing handle and then apply the swing holding brake or turn on the swing park switch.

Use the swing holding brake switch on the side of the handle to hold the rotating bed in position for short periods of time during the operating cycle. The swing brake will apply and the swing handle will be inoperable while the switch is pressed.

Press the button to apply the swing holding brake.

Release the button to release the swing holding brake.

## H – Travel Controls

See [Figure 3-14](#) for travel controls.

The crawlers have spring-applied, hydraulically-released disc brakes:

- Both crawler brakes release when either crawler handle is moved from off.
- Both crawler brakes apply when both crawler handles are moved to the off position.
- Both crawler brakes apply to hold the crane in position if the system loses power for any reason.

### H1. Travel Park Switch

Press the top of the rocker to turn the travel park switch on. With the travel park switch on, the travel handles are inoperable and the brakes apply.

Press the bottom of the rocker to turn the travel park switch off. With the travel park switch off, the travel handles are operable and the brakes apply and release in conjunction with handle movement.

### H2. Travel Speed Selector

Press the top of the rocker to operate the travel motors in high speed. High speed operation provides the maximum available travel speed for traveling long distances.

Press the bottom of the rocker to operate the travel motors in low speed. Low speed operation provides smoother starts and stops and more precise control of the travel motors than high speed.

In low speed, the travel motors operate at approximately 1/3 the speed of high speed.

**NOTE:** It is safe to change travel speed while traveling.

The travel motors will shift immediately from high to low when low speed is selected.

The travel motors will only shift from low to high when high speed is selected when the following conditions are met:

- Engine speed reaches high idle
- Hydraulic pressure is low enough to allow the motors to shift from low to high speed

### H3. Travel Cruise Selector (Optional)

The travel cruise selector enables the crawlers to operate at a selected speed while the crawler handles are in the off position.

To use travel cruise, move both crawler handles from off to select the desired speed and direction of travel. Press the top of the rocker to turn travel cruise on. Then, release the handles to the off position. The crawlers will travel at the selected speed and direction.

To turn travel cruise off, move either crawler handle in the opposite direction of travel or press the bottom of the rocker.

### H4. Left Crawler Handle

### H5. Right Crawler Handle

References to travel direction assume the front of the rotating bed and the front of the carbody are facing the same direction:

- The cab is at the front of the rotating bed.
- The carbody and crawler control valve is at the front of the carbody.

If the front of the rotating bed and front of the carbody face in opposite directions, the crane will travel opposite of the handle movement.

Push the handle forward to travel forward. The brakes will release and the speed will increase according to the handle movement.

Pull the handle back to travel in reverse. The brakes will release and the speed will increase according to the handle movement.

Release the handle to center to stop travel. The brake spring will apply.

The swing/travel alarm will beep during travel to warn personnel the crane is moving.

## J – Winch Controls

### Rigging Winch Mode

See Rigging Winch Operation topic in Section 4.

## LIMIT DEVICES

See [Table 3-2](#) for additional details on limits that can be bypassed.

### Boom Up Limit



#### WARNING

##### Falling Boom/Jib Hazard!

When bypassing the boom up limit for any reason, DO NOT allow the physical boom stops to bottom out. The boom butt could be damaged, causing the boom and jib to fall over backward.

##### Crush Hazard!

Maintain constant communication between the operator and assistant during the following steps.

Stay clear of moving parts.

The boom up limit stops the boom when it is raised to the following maximum angles:

- 84° for a boom without the luffing jib. The boom up limit **cannot be bypassed**.
- 88° for a boom with the luffing jib. The boom up limit **cannot be bypassed**.

The boom can be lowered after reaching the limit

### Block Up Limit



#### WARNING

##### Two-Blocking Hazard!

If it is necessary to hoist a load above the block-up limit, do so slowly with extreme caution to prevent two-blocking.

Do not hoist a load above the minimum block clearance given in the Range Diagram (see the Capacity Chart Manual).

The block-up limit stops the boom or luffing hoist and the load drums when the load contacts a block-up limit switch.

The load on the corresponding drum can be lowered and the boom or luffing jib can be raised after reaching a block-up limit switch.

## Luffing Jib Up Limit



#### WARNING

##### Falling Boom/Jib Hazard!

Proceed slowly when operating the luffing jib above the JIB MAXIMUM UP 1 limit.

Do not raise the luffing jib above the JIB MAXIMUM UP 2 limit. Structural damage will occur, possibly causing the boom and luffing jib to be pulled over backward.

The crane includes two luffing jib up limits:

- **JIB MAXIMUM UP 1**—(maximum working angle) This programmed limit stops the luffing jib when the boom to jib angle is 169°.
- **JIB MAXIMUM UP 2**—(maximum angle) This limit stops the luffing jib when the boom to jib angle is 170.5°.

This limit can only be bypassed when the boom is below 50° (during the luffing jib raising and lowering procedure).

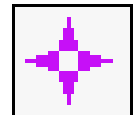
The luffing jib can be lowered after reaching either limit.

**NOTE:** The limit switch must be reset before lowering the luffing jib after reaching the jib maximum up 2 limit.

When the boom to jib angle reaches the limit, operation will stop and the jib up prompt (shown to right) will appear on the main display.



To reset the limit switch after the prompt appears, release the control handle to off and press the confirm button shown to the right. The luffing jib can then be lowered.



## Luffing Jib Down Limit



#### WARNING

##### Falling Boom/Jib Hazard!

Do not lower the luffing jib below the minimum angle given in the Luffing Jib Raising (and lowering) Procedure Chart. Structural damage could result, possibly causing the boom and luffing jib to collapse.

The crane includes two luffing jib down limits:

- **JIB MAXIMUM DOWN 1**—(minimum working angle) This programmed limit stops operation when the boom to jib angle is 70°.
- **JIB MAXIMUM DOWN 2**—(minimum angle) This limit stops the luffing jib when the boom to jib angle is 67°.



**NOTE:** The Jib Maximum Down 2 limit can be bypassed if the limit switch malfunctions.

If the limit switch stops the luffing jib before it reaches 67°:

- Release the control handle to center
- Turn the bypass switch to the bypass position
- Lower the luffing jib slowly to the specified minimum angle. Monitor the angle in the working screen of the RCI/RCL display

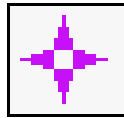
The luffing jib can be raised after reaching either limit

**NOTE:** To raise the luffing jib after reaching the Jib Maximum Down 2 limit, reset the limit switch.

When the boom to jib angle reaches the limit, operation will stop and the jib down prompt (shown to right) will appear on the main display.



To reset the limit switch after the prompt appears, release the control handle to off and press the confirm button shown to the right. The luffing jib can then be raised.



## Minimum Bail Limit



### **WARNING** Falling Load Hazard!

When lowering a load below the minimum bail limit, do so slowly with extreme caution. Do not lower the load to a point where less than three full wraps of wire rope are on a drum. The wire rope could be pulled out of the drum, allowing the load to fall.

The minimum bail limit stops the corresponding drum from lowering when there are three wraps of wire rope remaining on the drum.

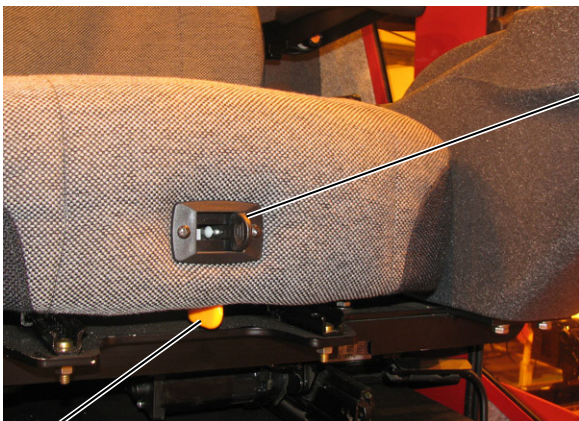
The load can be raised after reaching the limit.

## MAX-ER Mast Stop Retracted

Fault #27 will be active when Node-6 is not configured correctly for crane operation, even if the MAX-ER is not attached.

Connect the shorting plug to W66P8 when the mast stop cylinder is not present. Connect the shorting plug to port W6 of Node-6 when cable W66 is not present. See chapter 4 for detailed Node-6 configuration.

## SEAT CONTROLS



M101351

**BACKREST**

- Move switch up to release backrest.
- Use body weight to adjust backrest.
- Release switch to lock position of backrest.

**WARNING****Moving Load Hazard!**

Be aware that the backrest is spring loaded. If you get out of the seat to adjust the backrest, it will spring forward.

To prevent the backrest from springing forward into the control handles and activating crane functions, park all crane functions before getting out of the seat.

**SEAT FORE-AFT**

- Push lever to left to unlock.
- Use body weight to slide seat to desired position.
- Release lever and make sure it is latched to lock seat in position.



M101352

**ARMREST**

Turn knob clockwise to raise armrest or counterclockwise to lower

**SEAT HEIGHT AND POSITION**

- Move rear switch up or down to raise or lower seat rear.
- Move center switch to raise/lower seat and move it forward/backward.
- Move front switch up or down to

FIGURE 3-15

**CAUTION****Avoid Damage!**

Disconnect the electric cord from the rear of the left console before you remove the seat from the operator cab.

---

## PREPARING CRANE FOR OPERATION

---



### WARNING

#### Read Capacity Charts!

Do not attempt to operate the crane without first reading and understanding the capacity charts.

The crane must be rigged and operated according to the instructions given in the capacity charts and rigging guides.

Unless otherwise specified in the capacity charts, all crane operations shall be performed with the crane level to within 1% of grade in all directions—0,3 m in 30 m (1 ft in 100 ft) or the crane could tip.

Do not operate the crane, including raising the boom from ground level, if wind exceeds the limits given in the Capacity Charts. Contact your local weather station for wind velocity.

Failing to comply with the Capacity Chart requirements can result in tipping or structural failure of the boom or luffing jib.

#### Moving Load Hazard!

The operator shall select the proper crane capacity chart before operating the crane.

Unexpected drum motion or improper limit responses can result if the wrong capacity chart is selected.

All limits with which the crane is equipped must be operational before operating the crane. See the Service Manual supplied with your crane for adjustment procedures.

#### Avoid injuring personnel in operating area!

Sound the horn to alert personnel that operation is about to begin.

---

#### Moving Machinery Hazard!

To avoid injuring personnel or damaging the crane and property, use the following precautions:

- Do not start the engine if a warning or out-of-order sign is present at the start controls.
- Check that all controls are off so the crane and load do not move when the engine is started.
- Check that all personnel are clear of the crane before starting the engine. **Sound the horn to alert personnel.**

---

#### CAUTION

#### Avoid Machinery Damage!

Before operating the crane at the start of each shift, perform the preventive maintenance checks and lubrication requirements listed in Sections 5 and 6 of this manual.

Adjust the operator seat as shown in [Figure 3-15](#).

---

## OPERATION

### Engine Startup

#### CAUTION

##### Pump Damage!

Do not start the engine until the hydraulic tank shutoff valve is open or the pumps could cavitate and be damaged.

Read and understand starting instructions in the Cummins engine manual provided with crane:

1. If used, unplug or turn off the engine block heater, engine oil pan heater, hydraulic tank heaters and any other crane heaters.

**NOTE:** Manitowoc recommends using heaters (engine, hydraulic tank, etc.) to aid startup when the ambient temperature will be 0°C (32°F) or below.

2. Make sure that the hydraulic tank shutoff valve is open (see [Figure 3-16](#)).

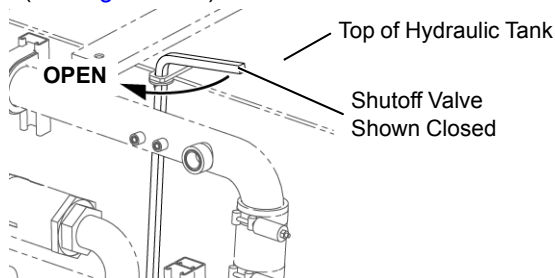


FIGURE 3-16

3. Turn the ignition switch to the run position.

**NOTE:** All indicator lights, operating limit buzzer, and system fault beeper should come on for two to three seconds when the ignition switch is in the run position. If they do not, replace defective parts.

#### CAUTION

##### Avoid Engine Clutch Damage!

Observe the following precautions for the engine clutch:

- **Decrease engine speed to idle** before engaging or disengaging the clutch.
- Do not run the engine longer than twenty minutes with the clutch disengaged.
- Disengage and engage the clutch several times monthly with the engine running.

4. If necessary in cold weather, disengage the engine clutch (see [Figure 3-4](#)) to disconnect the pumps from the engine and aid in cold weather startup.

5. Turn the ignition switch to the start position.

#### CAUTION

##### Starter Motor Damage!

If the engine does not start after 30 seconds of cranking, allow the starter motor to cool before trying again.

**NOTE:** If the engine does not start, check to see if the engine emergency stop switch or the remote control stop switch is depressed. If so, pull it out.

6. Increase engine speed as necessary to keep the engine running after it starts.
7. If the engine clutch is disengaged, decrease engine speed to low idle and engage the engine clutch within 20 minutes after starting the engine.

**NOTE:** The engine clutch may be engaged when the temperature of the hydraulic oil is above -18°C (0°F). The hydraulic tank heaters are designed to keep the temperature of the oil in the tank at a minimum of -18°C (0°F).

8. Run the engine at low idle until the hydraulic oil temperature is higher than 18°C (65°F) to turn off the hydraulic fluid temperature fault.

**NOTE:** It is normal for engine and crane faults to appear when the engine starts. The faults should go away when the engine oil pressure and hydraulic oil temperature rise to normal if no other faults exist.

#### CAUTION

##### Machinery Damage!

Do not operate the crane when any engine or crane faults exist. If faults do not go away soon after the engine is started, or if they come on during operation, immediately proceed as follows:

- Determine the fault on the Information screen
- Land any loads, if possible, and park all functions
- Move all control handles to off and stop the engine
- Correct the cause of the fault

9. Select the crane configuration and capacity charts on RCL display, Configuration screen. The load drums and hoist drums are inoperable until this step is performed.

#### CAUTION

##### Machinery Damage!

Continuous operation with the hydraulic oil temperature above 82°C (180°F) can result in damage to hydraulic components. Troubleshoot the hydraulic system if the oil temperature exceeds 82°C (180°F).

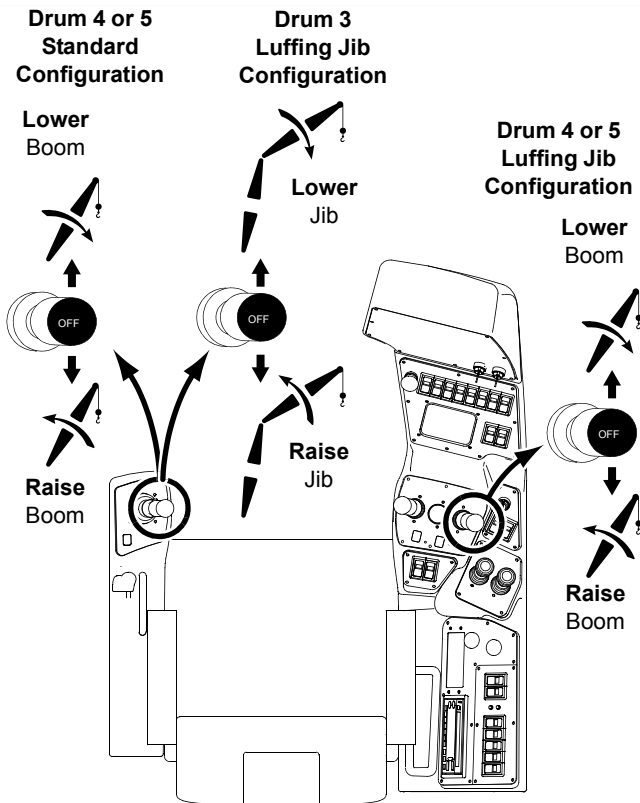


FIGURE 3-17

**Boom/Mast Hoist Operation**

See [Figure 3-17](#) for boom/mast hoist operation.

**CAUTION**

**Mast Assist Damage!**

Prevent damage to the mast assist arms and cylinders during cold weather:

- Do not attempt to lower the live mast with the boom hoist/mast hoist until the temperature of the hydraulic oil is 16°C (60°F).
- Once the oil is at the specified temperature, fully extend and retract the mast assist cylinders twice to fill the cylinders with warm oil.
- The cylinders and arms will bend under the weight of the mast if these precautions are not taken.

In standard configuration, the boom/mast hoist handle is on the left console. When the crane is configured with a luffing jib, the boom/mast hoist handle is the last load drum handle D on right console:

1. Select the crane configuration and capacity charts on the RCL display, Configuration screen.
2. Turn the Drum 4 or Drum 5 park switch off.

**CAUTION**

**Avoid Boom or Jib Damage!**

Do not turn on the drum park switch while raising or lowering the boom. The brake will bring the boom to an abrupt stop, which could cause shock load damage to the boom and jib. Bring the boom to a smooth stop using the handle and then turn on the drum park switch.

3. Increase engine speed to the desired RPM with the hand throttle. Press the foot throttle to increase engine speed momentarily when more power is required.



**WARNING**

**Avoid Two-Blocking Hazard!**

Pay out the load lines while lowering the boom. The load may contact the boom point or jib point sheaves if this step is not taken. Wire rope or other parts could break, allowing the load to fall.

4. Push the boom/mast hoist handle forward to lower the boom or pull the handle back to raise it. See [Figure 3-17](#).
5. As the boom nears the desired angle, slowly move the handle to off to stop the boom. Hold the handle in position to apply the brake.

**NOTE:** Besides a boom up limit, a physical boom stop cushions the boom between approximately 78° and the maximum angle. The boom stop physically stops the boom at 90°.

6. Turn the park switch on if the boom angle will not change.

**CAUTION**

**Avoid Rigging Damage!**

When lowering the boom to the ground, use the following precautions:

- If equipped, disconnect the fixed jib stop before the jib point contacts the ground.
- If equipped, remove the upper boom point before the upper point contacts the ground.
- If equipped, disengage the luffing jib stop at the specified boom-to-luffing-jib angle (see the Luffing Jib Rigging Guide).

## Luffing Hoist Operation

See [Figure 3-17](#) for luffing hoist operation.

When the crane is configured with a luffing jib (Drum 3), the multi-function handle on the left console controls the luffing jib drum (See [Figure 3-17](#)).



### WARNING

#### Avoid Death or Serious Injury!

Read and understand the instructions in the Luffing Jib Rigging Guide before attempting to raise or lower the luffing jib from or to the ground.

Use extreme care when operating the luffing hoist and boom hoist at the same time. The maximum or minimum operating radius will be reached quickly when operating both hoists at the same time.

### CAUTION

#### Avoid Rigging Damage!

Check that the luffing hoist wire rope is reeved through all sheaves and spooled properly onto Drum 3 before raising the boom and jib from the ground. See the Jib Rigging Drawing in the Luffing Jib Operator Manual for wire rope and reeving specifications.

See the Wire Rope Installation topic in Section 4 for instructions on attaching wire rope to the luffing hoist drum.

To operate the luffing hoist, use the following:

1. Select the luffing jib configuration and capacity charts on the RCL display, Configuration screen.
2. Turn the Drum 3 park switch off.

### CAUTION

#### Avoid Boom or Luffing Jib Damage!

Do not turn on the Drum 3 park switch while raising or lowering the luffing jib. The brake will bring the luffing jib to an abrupt stop, which could cause shock load damage to the boom and jib. Bring the luffing jib to a smooth stop using the control handle and then turn on the Drum 3 park switch.

3. Increase engine speed to the desired RPM with the hand throttle. Press the foot throttle to increase engine speed momentarily when more power is required.



### WARNING

#### Avoid Two-Blocking Hazard!

Pay out the load lines while lowering the luffing jib. The load may contact the luffing jib point sheaves if this step is not taken. Wire rope or other parts could break, allowing the load to fall.

4. Push the luffing hoist handle (Drum 3) on the right console forward to lower the luffing jib. Pull the handle back to raise the luffing jib. See [Figure 3-17](#).
5. As the luffing jib nears the desired angle, slowly move the luffing hoist handle to off to stop the luffing jib. Hold the handle in position to apply the brake.

Turn the drum 3 park switch on if the luffing jib angle will not change.

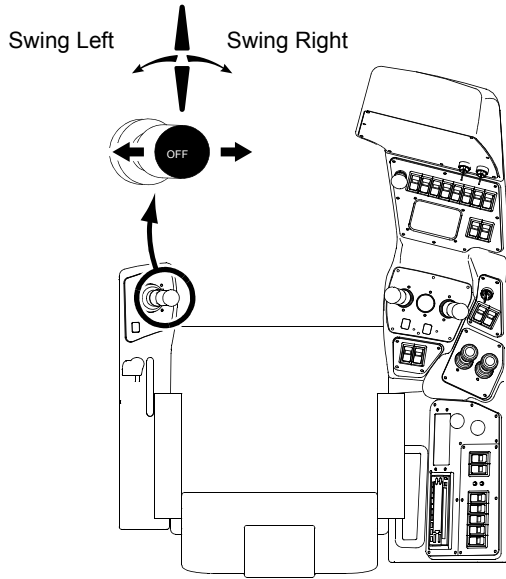


FIGURE 3-18

### Swing Operation

See [Figure 3-18](#) for swing operation.

**! WARNING**  
**Tipping Hazard!**

Prevent the crane from tipping. Adhere to any swing limitations given in the capacity charts.

**! DANGER!**  
**Moving Crane Hazard!**

Counterweights can strike personnel in the area of the swing path. Warn personnel to stay clear of the swing path. Sound the horn prior to swinging.

To operate the swing function, use the following:

1. Turn the swing park switch off.

**CAUTION**

**Avoid Boom/Swing Drive Damage!**

Do not apply the swing holding brake or turn on the swing park switch while swinging. The brake will bring the rotating bed to an abrupt stop, which could cause damage to the boom and luffing jib from side loading or damage to the swing drive from shock loading. Bring the rotating bed to a smooth stop using the swing handle and then apply the swing holding brake or turn on the swing park switch.

2. Increase engine speed to the desired RPM with the hand throttle. Press the foot throttle to increase engine speed momentarily when more power is required.
3. Push the swing handle to the left to swing left. Pull the handle to the right to swing right. See [Figure 3-18](#).
4. Start swing motion with a smooth acceleration. Continue the handle motion to swing at the desired speed.

Adjust swing speed and torque as desired on the Main display, Function Mode screen.

If the crane is equipped with optional swing limits, adjust the switches to stop the rotating bed at the desired position in either direction.

5. Stop swinging by releasing the swing handle to off. Swing speed will decrease to off and the rotating bed will coast to a stop. To stop faster, move the swing handle past off to the opposite swing direction.
6. When the rotating bed stops, apply the swing holding brake to hold the rotating bed in position for short periods during operation.

To hold the rotating bed in position for long periods, turn the swing park switch on.

## Load Drum Operation

See [Figure 3-19](#) for load drum operation.

**NOTE:** See the Drum and Lagging Chart in the Capacity Chart Manual for drum identification.



### WARNING

#### Falling Load Hazard!

Prevent load on any unused drums from falling. Turn on the drum park switch for drums not in use.

To operate a load drum, use the following:

1. Select the crane configuration and capacity charts on the RCL display, Configuration screen.
2. Turn the drum park switch off for the desired drum.

### CAUTION

#### Avoid Boom or Luffing Jib Damage!

Do not turn on the drum park switch while raising or lowering a load. The brake will bring the load to an abrupt stop, which could cause shock load damage to the boom, luffing jib, and load line. Bring the load to a smooth stop using the drum handle and then turn on the drum park switch.

3. Increase engine speed to the desired RPM with the hand throttle. Press the foot throttle to increase engine speed momentarily when more power is required.
4. Pull the drum handle (Drum 1, 2, or 3) back to raise the load. Push the handle forward to lower the load.
5. As the load nears the desired position, slowly move the drum handle to off to stop the load. Hold the handle in position to apply the drum brake.

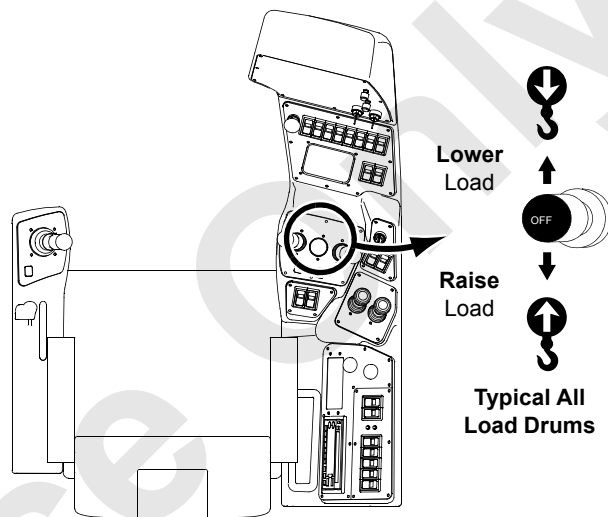


FIGURE 3-19



## Travel Operation



### WARNING

#### Tipping Hazard!

The travel surface must be firm and uniformly supporting.

When **traveling with a load**, the grade must not exceed 1% in any direction.

When **traveling without a load**, the grade in the direction of travel must not exceed 30%. The grade from side to side must not exceed 2%, measured at the boom hinge pins. For all travel on grades, see the Maximum Allowable Travel Specifications Chart in the Capacity Chart Manual.

Failing to comply with the above specifications can result in tipping.

#### Moving Crane Hazard!

Know the position of the rotating bed with relation to the front of the carbody before traveling. An accident can result if the crane travels opposite of the intended direction.

#### Flying Object Hazard!

Excessive dirt build-up at the tumbler and front roller ends of the crawlers can result in excessive tension in the tread connectors. Tread connectors can break if they are over-tensioned, causing the treads to fly apart unexpectedly with dangerous force.

### CAUTION

#### Crawler Damage!

Avoid damage to the crawler components (treads, rollers, frames).

Use care to prevent dirt from piling up at the tumbler and front roller ends of the crawlers when turning on soft surfaces:

- Bring the crawlers to a complete stop before changing travel direction.
- Turn a few degrees. Then slowly travel forward or reverse so dirt falls away from the crawlers. Continue this procedure until the desired turn is complete.
- Avoid sharp turns ([Figure 3-21](#)) if possible.
- Make gradual turns ([Figure 3-22](#)) or counter-rotate ([Figure 3-23](#)) whenever possible so both crawlers are always powered.
- Clean the crawlers often.
- Keep the crawler treads properly adjusted.

### CAUTION

#### Boom Damage!

Avoid shock loading the boom and rigging. Perform all travel functions—starting, turning, and stopping—slowly and smoothly.

To travel, use the following:

1. Before traveling, complete the following:
  - a. Plan the travel route to be free of ground and overhead constructions.
  - b. Check the crawlers for proper adjustment.
  - c. Warn personnel to stand clear of travel area. **Do not travel without a signal person.**
2. When **traveling with load**, position the boom at or above the boom angle given on capacity chart.
3. Travel with the boom in line with the crawlers unless swinging is necessary while traveling. Travel with the boom facing the direction of travel.
4. For **traveling with load**, carry the load as close to ground as possible and stabilize the load with taglines.
 

For **traveling without load**, carry the load block and weight ball low enough they cannot swing into the boom or jib, or tie off the load block at the front of the rotating bed.
5. Increase engine speed to the desired RPM with the hand throttle. Press the foot throttle to increase engine speed momentarily when more power is required.
6. Select the desired travel speed, low or high.

**NOTE:** Travel directions assume the front of the rotating bed and the front of the carbody are facing the same direction:

- The cab is at the front of the rotating bed.
- The carbody/crawler control valve is at the front of the carbody.

If the front of the rotating bed and the front of the carbody face in opposite directions, the crane will travel in the direction opposite of handle movement.

- To travel straight (Figure 3-20), move both crawler handles the same amount in the desired direction.

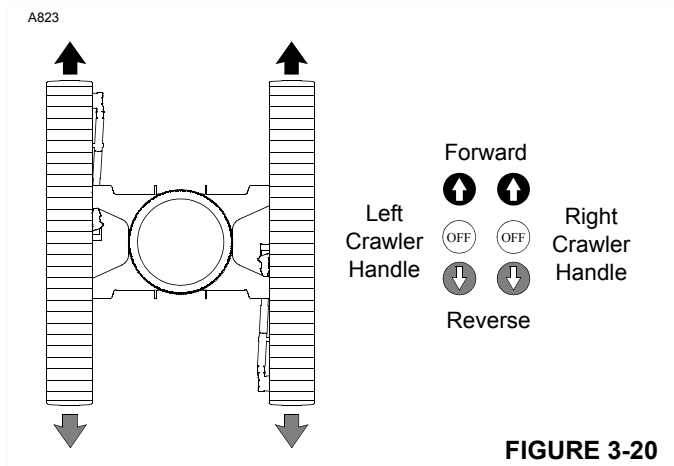


FIGURE 3-20

- To make a sharp left turn (Figure 3-21), move the right crawler handle to the front and leave the left crawler handle in off. The crane will pivot about the left crawler.
- To make a sharp right turn, reverse step 8.

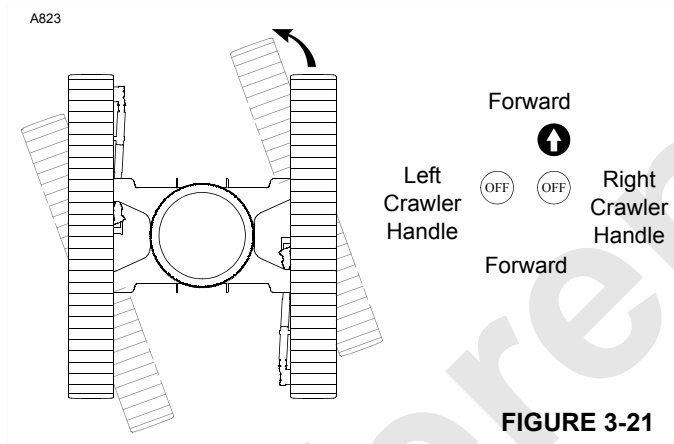


FIGURE 3-21

- To make a gradual left turn (Figure 3-22), move both crawler handles to the front, moving the right crawler handle farther than the left crawler handle. The right crawler will turn faster than the left crawler.

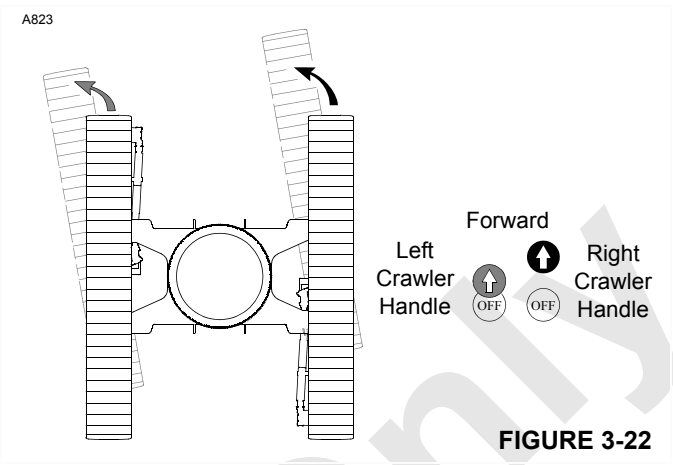


FIGURE 3-22

- To make a gradual right turn, reverse step 10.
- To counter-rotate left (Figure 3-23), move the right crawler handle to the front and move the left crawler handle to the back.

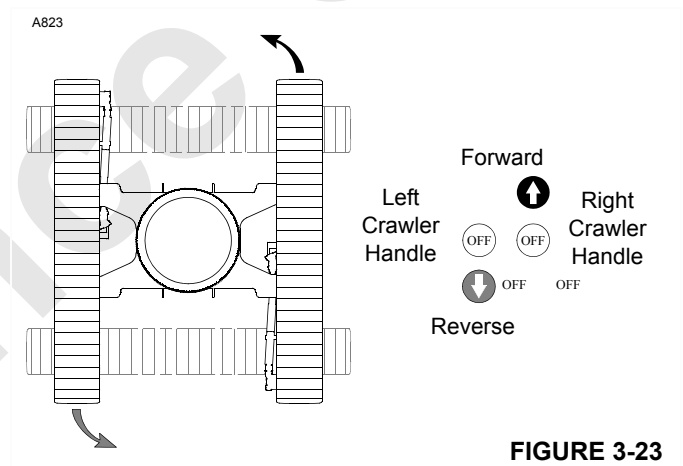


FIGURE 3-23

- To counter-rotate right, reverse step 12.
- To stop traveling and hold the crane in position, slowly move both crawler handles to off.
- Turn the travel park switch on.

## STOPPING ENGINE/ LEAVING CRANE UNATTENDED



### WARNING

#### Moving Load/Tipping Crane Hazard!

The operator shall not leave the operator cab until the crane, loads, and boom have been secured against movement.

Changing weather conditions, including but not limited to wind, ice or snow accumulation, precipitation, flooding, and lightning, should be considered when determining the location and configuration of a crane when it will be left unattended.

To leave the crane unattended, use the following:

1. Travel onto a level surface. Do not leave the crane unattended on a grade.
2. Turn the travel park switch on.
3. Swing the rotating bed to the desired position and turn the swing park switch on.
4. Lower all loads to the ground.
5. Turn the drum park switch on for each load drum.
6. If possible, lower the boom and luffing jib onto blocking at ground level and turn the boom park switch on.

If the boom and luffing jib cannot be lowered, as determined by a qualified designated person, they must be secure from movement by wind or other outside forces (see Wind Conditions in Capacity Chart Manual).

**NOTE:** The designated person shall be familiar with job site limitations, crane configuration, and expected weather conditions.

7. Make sure that all control handles are off.
8. Decrease engine speed to idle.  
Allow the engine to idle for three to five minutes to cool evenly.
9. Stop the engine.
10. Remove all keys from the cab to prevent unauthorized operation.
11. Lock the cab windows and door to prevent unauthorized entry.

## REMOTE CONTROLS



### WARNING

#### Read Instructions!

To avoid death or serious injury to personnel and damage to the crane, read the Crane Assembly and Disassembly Instructions in Section 4 before operating the remote controls.

The following describes operation of the remote controls used for crane assembly and disassembly. Disregard any control not equipped on your crane.

This crane has two types of remote controls:

- Electronic crane setup remote control:
  - [Figure 3-24](#) shows wireless remote controls
  - [Figure 3-25](#) shows wired remote controls
- **Manual** carbody remote control shown in [Figure 3-32](#)

### Remote Control Priority

If two remote controls are operated at the same time, only the remote control with the higher priority will operate. The other remote control will be turned off.

The remote controls use the following operating priorities:

- Priority 1—Carbody Manual Remote Controls
- Priority 2—Crane Setup Remote Control
- Priority 3—Wheeled MAX-ER Setup Remote Control
- Priority 4—Hanging MAX-ER Setup Remote Control

**NOTE:** The swing and travel alarm sound continuously when the above controls perform any function.

### Wireless Remote Battery Replacement

Two AA size batteries in the control handle power the wireless remote control. The Main display, CAN Bus screen shows the battery status. The wireless icon displays the following:

- 16 and 32 On — 75% and up battery charge
- 32 On, 16 Off — 50% to 75% battery charge
- 32 Off, 16 On — 25% to 50% battery charge
- Both Off — 0% to 25% battery charge

To replace the batteries, use the following:

1. Remove the end cap at the bottom of the control handle.
2. Make sure the seal gasket remains in place.
3. Remove the old batteries.
4. Insert with two AA Lithium type batteries.

**NOTE:** Alkaline AA type batteries are acceptable, but alkaline batteries reduce battery life.

### Wireless Remote Controls



Remote Control Stored on Shelf Behind Seat in Cab

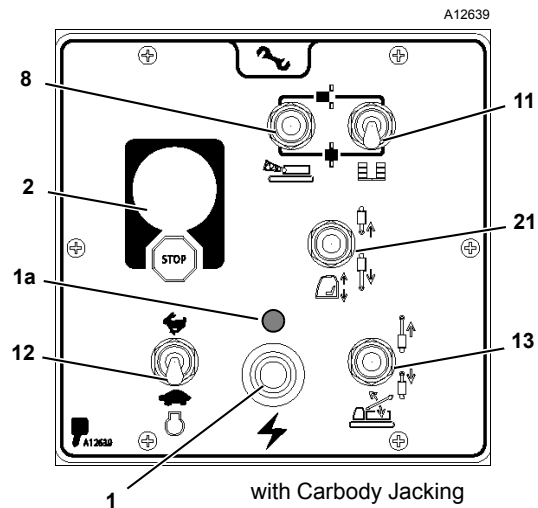
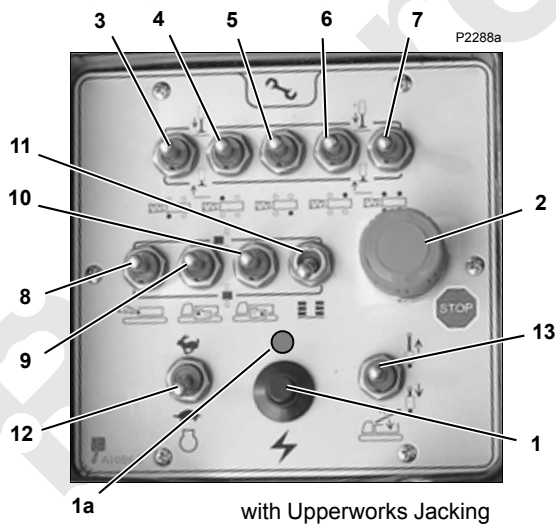
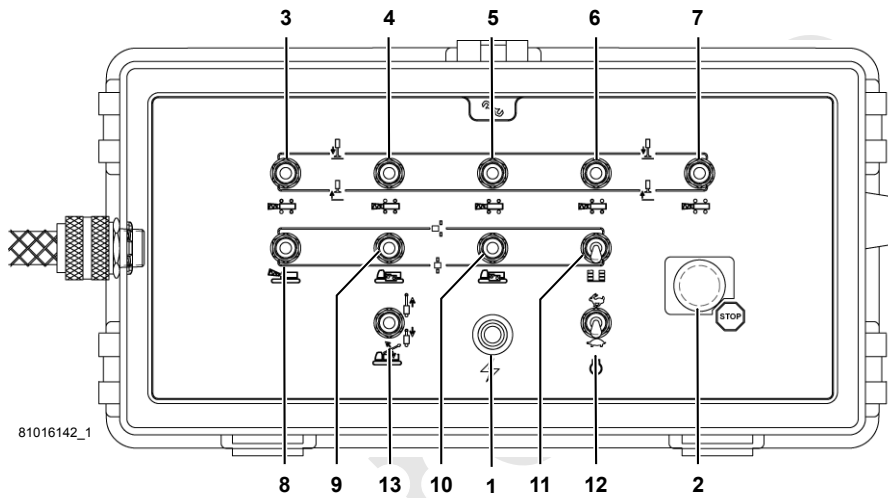
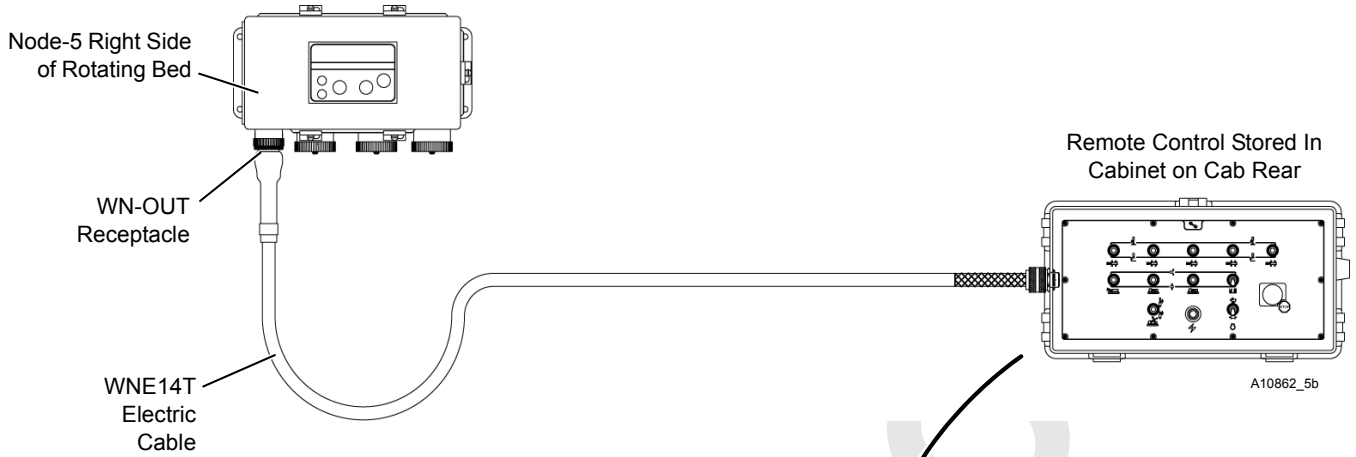
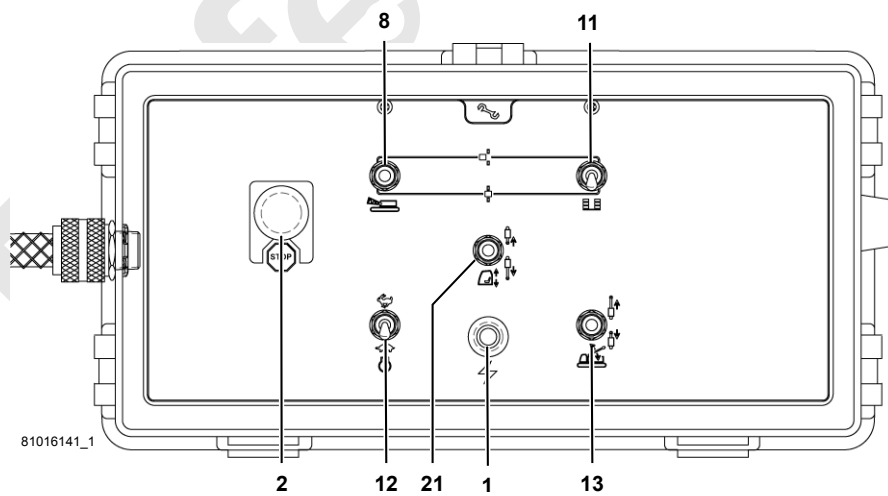


FIGURE 3-24

### Wired Remote Controls



**View A**  
with Upperworks Jacking



**View B**  
with Carbody Jacking

**FIGURE 3-25**

3

## Crane Setup Remote Control Activation

### Wireless Remote Control

The wireless remote control can operate in any mode.

A slight delay is normal from the time a remote toggle switch is enabled to the time the corresponding function operates.

To turn the wireless remote control on, use the following:

1. Enter the function mode screen on the main display ([Figure 3-26](#)).

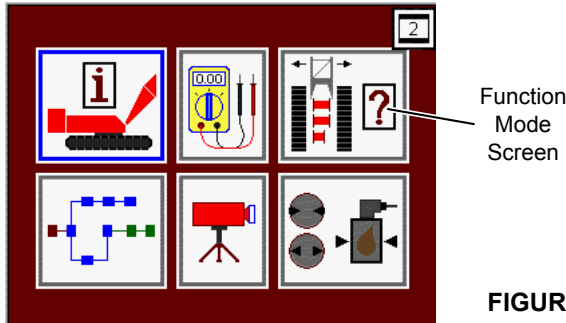


FIGURE 3-26

2. Scroll to the setup screen with the wrench icon shown in ([Figure 3-27](#)).

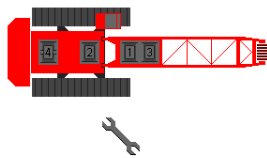


FIGURE 3-27

3. The screen in [Figure 3-28](#) will appear.

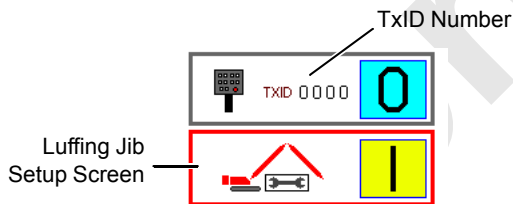


FIGURE 3-28

4. Make sure the TXID number on the screen matches the number on top of the remote control. If the numbers do not match, enter the number from the remote control into the TXID field on the screen.
5. Press and hold the power button on the remote control.
6. Scroll up or down to turn the remote control on.
7. Continue to hold the power button on the remote control until the remote control ON



prompt (shown to right) flashes on the display. This could take 5 to 10 seconds.

The flashing prompt indicates the remote control is communicating properly.

8. Exit the remote control data box to save the setting.

The remote control will remain on and the remote control ON prompt will remain on the display until the remote control is turned off.

To turn the wireless remote off, use the same procedure and scroll to the off setting in step 6.

### Wired Remote Control

The wired remote control can operate in any mode.

A slight delay is normal from the time a remote toggle switch is enabled to the time a corresponding function operates.

To turn the wired remote control on, use the following:

1. Remove the remote control from the container on the rear of the cab.
2. Disconnect the electric cable (WNE14T) from the WN-OUT receptacle on Node-5 (see [Figure 3-25](#)).
3. Connect the electric cable from the wired remote to the WN-OUT receptacle on Node-5.
4. Enter the function mode screen on the main display ([Figure 3-29](#)).

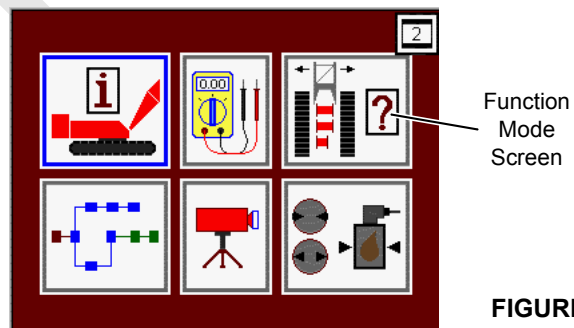


FIGURE 3-29

5. Scroll to the setup screen with the wrench icon ([Figure 3-30](#)).

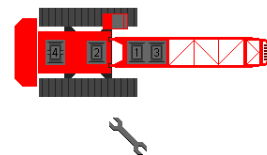


FIGURE 3-30

6. On the function mode screen, enter the remote control data box ([Figure 3-31](#)).



14-COM-3-23

Remote Control  
ON

FIGURE 3-31

7. Scroll up or down to turn the remote control on (I).  
The remote control ON prompt remains on the display until the remote control is turned off.
8. Exit the remote control data box to save the setting.
9. Press and hold the power button on the remote control.
10. Move the selected switch to operate a function.

To turn the wired remote off, use the same procedure and scroll to the off setting in step 7.

## Crane Setup Remote Controls Operation

For wireless remotes, see [Figure 3-24](#). For wired remotes, see [Figure 3-25](#).

### 1–Power Switch

Press the power switch button to turn battery power to the remote controls on.

Release the power switch button to turn battery power to the remote controls off.

#### 1a–Power Light (Wireless Remotes Only)

The power light glows amber when wireless remote power is on.

### 2–Stop Switch

In an emergency only, press the stop switch knob to stop the engine and all remote controlled functions—for example, if a function does not stop when the control is released to off or uncontrolled motion of a function is observed.

**When using the stop switch knob, the engine and all operating functions come to an abrupt stop.** Always use the ignition switch in the cab to stop the engine in normal operating conditions.

**NOTE:** The stop switch knob must be up to restart the engine and operate remote controlled functions.

#### 3–Left Front Jacking Toggle Switch

#### 4–Right Front Jacking Toggle Switch

#### 5–Left Rear Jacking Toggle Switch

#### 6–Right Rear Jacking Toggle Switch

#### 7–All Jacking Toggle Switch

## WARNING

### Moving Part Hazard!

To avoid a serious crushing injury, use the following precautions:

- Keep all feet clear of the moving jacks.
- Warn all personnel to stay clear of the jacks while they are being extended.

### Tipping Hazard!

Keep the crane as level as possible while jacking. Do not allow the crane to get more than 4.5° out of level while jacking to prevent the crane from collapsing due to structural failure of the jacks.

Move the selected jacking toggle switch up and hold it to extend the jacking cylinder.

Move the selected jacking toggle switch down and hold it to retract the jacking cylinder.

Release the jacking toggle switch to the center to stop the jacking cylinder.

Use the ALL jacking toggle switch to operate all four jacking cylinders at the same time in one direction.

## CAUTION

### Machinery Damage!

To avoid damage to the jacking cylinders, fully retract them before traveling.

**NOTE:** The travel and swing alarm will sound while jacking with any switch on the remote control.

If the crane is out of level approximately 3° to 4-1/2°, jacking will continue. If the crane swing and travel alarm will sound at a lower pitch than normal to alert personnel and fault 4 will appear in the fault screen of the main display (see [Table 3-3](#)).

If the crane is out of level more than 4-1/2°, jacking will stop. The ALL switch will be inoperable, the swing and travel alarm will sound at a lower pitch than normal to alert personnel, and fault 43 will appear in the fault screen of the main display (see [Table 3-3](#)).

Level the crane using the individual jacking switches.

### 8-Boom Pins Switch

---



#### **WARNING**

##### **Falling Load Hazard!**

To prevent the boom or boom butt from falling off the crane, use the following precautions:

- Do not disengage the boom hinge pins until the boom butt is properly supported on stands at the ground level. The boom/boom butt could fall off crane.
- Read the Boom Rigging Guide in Section 4.

---

Move the boom pin toggle up and hold it to engage the boom hinge pins.

Move the boom pin toggle down and hold it to disengage the boom hinge pins.

Release the boom pin toggle to center to stop the pins.

### 9-Front Rotating Bed Pins Switch

### 10-Rear Rotating Bed Pins Switch

Move the selected toggle up and hold it to engage the rotating bed pins.

Move the selected toggle down and hold it to disengage the rotating bed pins.

Release the toggle to center to stop the pins.

### 11-Counterweight Pins Switch

Move the counterweight pins toggle down and hold it to disengage the counterweight pins. Release the toggle to return the counterweight pins to the engaged position.

### 12-Engine Speed Switch

Use the engine speed switch to select high or low engine idle speed from a remote position. The speed of operation (jacks and pins) depends on toggle switch movement and engine speed. To provide adequate speed for some items, the engine should operate at high idle.

Move the engine speed toggle up to operate the engine at high idle (approximately 1,500 RPM maximum).

Move the engine speed toggle down to operate the engine at low idle.

### 13-Mast Switch

Move the mast switch toggle up and hold it to raise the live mast arms with the mast cylinders.

Move the mast switch toggle down and hold it to lower the live mast arms with the mast cylinders.

Release the toggle to center to stop the mast cylinders. Valves on the cylinders lock them in position.

Read the Crane Assembly and Disassembly topics in section 4 for instructions to raise and lower the live mast.

### 14-Cab Raise/Lower Switch

The cab raise/lower switch lowers the cab out of working position or raises the cab into working position.



### Carbody Remote Controls Operation

The jack and pin operating speed depends on control handle movement and engine speed. To provide adequate engine speed, operate the engine at mid to high idle.

All control handles are spring returned to off.

See [Figure 3-32](#) for the following items.

**15–Right Crawler Pin Handle**

**16–Left Crawler Pin Handle**

Push the selected crawler pin handle up to disengage the crawler pins.

Pull the selected crawler pin handle down to engage the crawler pins.

Release the handle to center when pins are fully engaged or disengaged.

**NOTE:** Optional carbody jacking allows transportation of the carbody, adapter frame, rotating bed and cab as one unit.

**17–Right Front Carbody Jack Handle**

**18–Right Rear Carbody Jack Handle**

**19–Left Rear Carbody Jack Handle**

**20–Left Front Carbody Jack Handle**

**! WARNING**  
**Moving Part Hazard!**

To avoid a serious crushing injury, use the following precautions

- Keep all feet clear of moving jacks.
- Warn all personnel to stay clear of the jacks while they are being extended.

**Tipping Hazard!**

Keep the crane as level as possible while jacking. Do not allow the crane to get more than 3° out of level while jacking to prevent the crane from collapsing due to structural failure of the jacks. Monitor the carbody level while jacking.

Push the jack handle toward the carbody to retract the jack and lower the carbody.

Pull the jack handle away from the carbody extend the jack and raise the carbody.

Release the handle to center to stop the jack. Valves on the jack will lock it in position.

**CAUTION**  
**Machinery Damage!**

To avoid damage to the carbody jacks, fully retract the jacks before traveling.

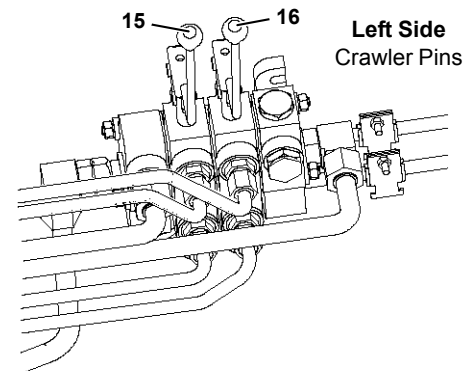
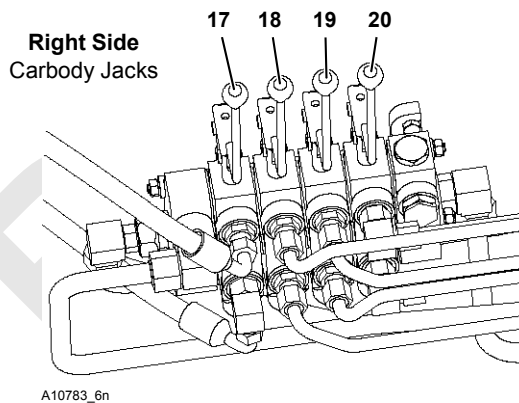


FIGURE 3-32

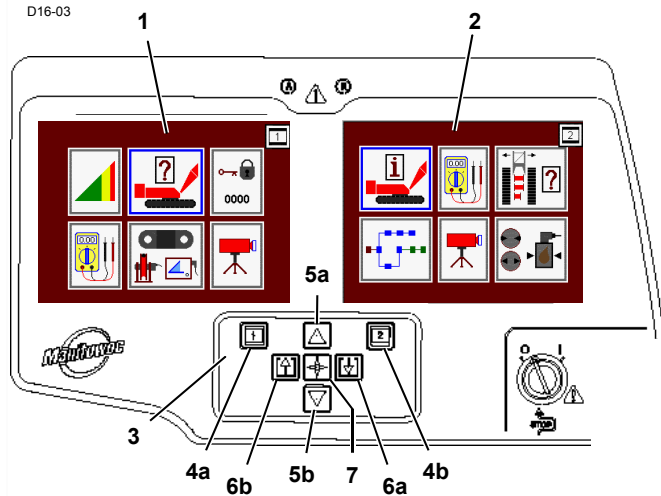
## DISPLAYS

### Navigation and Settings

#### Display Navigation

See [Figure 3-33](#)

The Menu screens for the RCI and crane display select buttons. Use the following controls on the display screens.



Item	Description
1	Rated Capacity Indicator/Limiter Display
2	Main Display
3	Display Touch Pad Controls
4a and 4b	Display Select Buttons
5a and 5b	Select Buttons
6a and 6b	Enter/Exit Buttons
7	Confirm Buttons

FIGURE 3-33

#### Rated Capacity Indicator (RCI) Display

Rated Capacity Indicator/Limiter (RCI) display is on the left side of front console. See the RCI manual for operation.

#### Main Display

The main display is on the right side of the front console. The main display screens are described in this section.

#### Display Touchpad Controls

The display touchpad contains all the screen controls required to operate the RCI display and Main display screens.

#### Display Select Buttons

- 4a. Screen 1(RCI) select
- 4b. Screen 2(Main Display) select

#### Select Buttons

Use the green select touchpad buttons to select screen images, icons or data boxes, and values or icons within the data boxes.

- 5a. Scroll Up
- 5b. Scroll Down

#### Enter/Exit Buttons

Use the red touchpad buttons to enter or exit a screen or to change the screen's operating level.

- 6a. Enter
- 6b. Exit

Use the enter button (6a) to enter a screen or go to the next level. Use the exit button (6b) to exit a screen or go to the previous level.

#### Confirm Button

Use the purple touchpad button (Confirm) to start certain test routines from the screen and to confirm data when required.

#### Display Brightness and Color Contrast

To adjust the display brightness and contrast, use the following:

1. Press the desired display select button (4a or 4b) and the confirm button (7) at the same time.
2. Release the confirm button (7) first and the display select button (4a or 4b) second.
3. Press the scroll up button (5a) to lighten the display, or press the scroll down button (5b) to darken the display.
4. Press the enter button (6a) to increase color intensity, or press the exit button (6b) to decrease color intensity.
5. Press the confirm button (7).

#### Restore Factory Default Display Settings

To restore a display to the factory default settings, use the following:

1. Select the screen to adjust by holding the confirm button (7) and the desired display select button (4a or 4b).
2. Release the confirm button first (7) and the display select button (4a or 4b) second.
3. Press both the scroll up (5a) and scroll down (5b) buttons at the same time.
4. Press the confirm button (7)

The selected screen (1 or 2) resets to factory default settings.

**Blank Display**

If a display is blank, use the following procedure to restore the display. **Do not return a display to Manitowoc until completing this procedure:**

1. Select the screen to adjust by holding the confirm button (7) and the desired display select button (4a or 4b).
2. Release the confirm button first (7) and the display select button (4a or 4b) second.
3. Press both the scroll up (5a) and scroll down (5b) buttons at the same time.
4. Press the confirm button (7)

**Main Display**

The basic components of the Main Display are the Information, Diagnostic, Function Mode, CAN Bus, Camera, and Pressure Test and Calibration screens.

The appearance and function of each screen depends on the screen level. Some screen levels show icons and/or data boxes that can be selected to change parameters and/or to enter different screen levels.

**“Manitowoc” Screen**

The initial view at crane startup is the “Manitowoc” screen, shown in [Figure 3-34](#). The Manitowoc screen displays the following:

- Model/ Program Number (example: 16000 FCN 1.012)
- Con Number (example: 009 000 000 008)
- Screen Program Number (example: GUI 2.007)



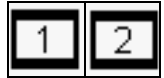
**FIGURE 3-34**

D16 LMI-2a

**Screen Prompts**

Screen prompts can appear on a selected screen if a fault condition exists or to prompt or confirm certain actions when the system requires.

To select the RCL Display, press and hold the confirm key and then key 1. Then release the confirm key.



To select the Main Display, press and hold the confirm key, and then key 2. Then release the confirm key.

The yellow alert symbol displays if a system fault occurs. See the [Information Screen](#) topic in this section for fault information.



The engine alert symbol displays when the engine needs service at the first available opportunity (for example, water-in-fuel detected or coolant level low).

The purple confirm prompt displays to start certain test routines from the screen and to confirm data when required.



The wireless remote symbol displays when the hand-held wireless remote is enabled.



The engine stopped symbol displays when the engine is stopped.



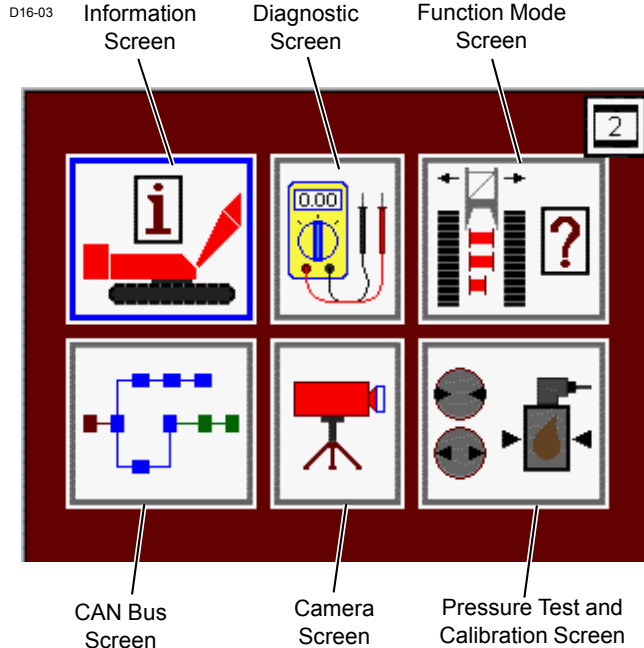
The data logger icon displays for 60 seconds at startup if there is a problem with the data logger (most likely caused by the real time clock).



**Menu Screen**

See [Figure 3-35](#)

The Menu screen is the base screen for the crane system and contains navigation to all other screens. Exiting from any screen returns to the Menu screen.



**FIGURE 3-35**

The Menu screen shows six screen icons:

- Information Screen
- Diagnostic Screen
- Function Mode Screen
- CAN Bus Screen
- Camera Screen
- Pressure Test and Calibration Screen

The Menu screen operates only on one level:

- Use the select buttons to highlight the desired screen icon. Press the enter button to go to the selected screen.
- To return to the Menu screen, press the exit button until the Menu screen appears.

**Information Screen**

See [Figure 3-36](#)

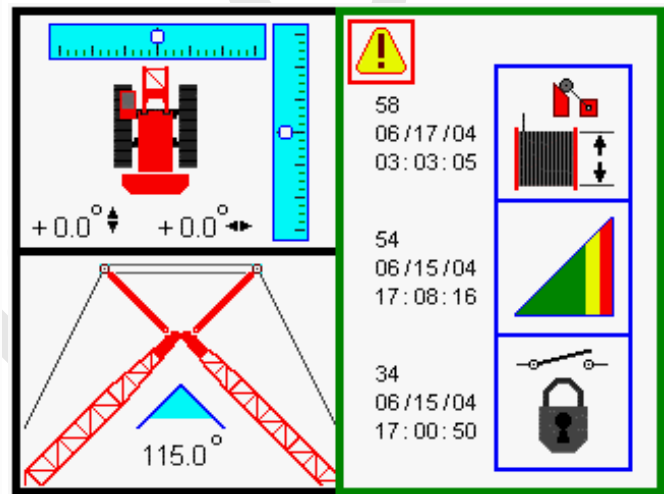
The Information screen shows all the general crane information required during normal operation. Three data boxes show the information appropriate for the current crane application.

The Information screen operates on three levels:

**Level 1**—The selected data box is highlighted blue. Use the select buttons to highlight the data box to change.

**Level 2**—The selected data box is highlighted red. Use the select buttons to choose the information to be shown in the highlighted data box.

**Level 3**—The selected data box is highlighted green (if applicable). Use the select buttons to change the information displayed in the highlighted data box.



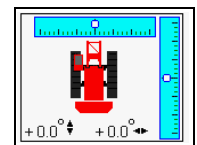
**FIGURE 3-36**

**Crane Information**

The crane information items (if equipped) for the two data boxes on the left side of the screen are:

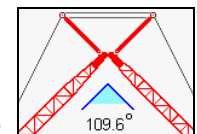
**Crane Level**

The Crane level icon displays the crane level forward to rear and side to side. Unless otherwise specified in capacity charts, all crane operations shall be performed with the crane level to within one 1% of grade in all directions—0.3 m in 30 m (1 ft in 100 ft)—or the crane could tip.



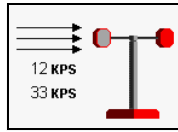
**Boom to Luffing Jib Working Angle**

The Boom to luffing jib icon displays the boom to jib working angle between the center line of the boom and the center line of the luffing jib.



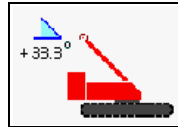
**Wind Speed Indicator**

The wind speed icon displays the steady wind speed and the maximum gust wind speed. To reset the indicator, press the confirm button in level 3.



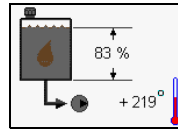
**Mast Angle**

The mast angle icon displays the angle, in degrees, the mast is positioned above the transport position.



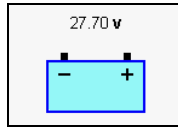
**Hydraulic Tank**

The hydraulic tank icon displays the tank fluid level in percent and the temperature in degrees.



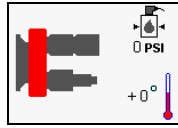
**Battery**

The battery icon displays the active battery voltage.



**Pump Drive**

The pump drive icon displays the oil pressure and temperature of the pump drive cooling system.



**MAX-ER Icons**

The MAX-ER counterweight lift position and telescopic beam extend icons are not shown. See the MAX-ER Operator Manual for complete MAX-ER attachment information.

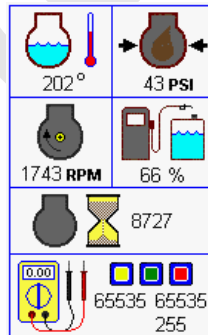
**MAX-ER (Optional)**

The MAX-ER data box displays the MAX-ER wheel position icons (not shown). See the MAX-ER Operator Manual for complete MAX-ER attachment information.

**Engine Information**

The Engine information box displays the following:

- The engine coolant temperature [should be below 96°C (204°F)]
- The engine oil pressure [should be above 1 bar (15 psi)]
- The engine speed in RPM
- The fuel level in percent of fuel in the main tank
- The total number of hours engine has run
- The diagnostic box with the engine manufacturer’s fault code/flash code. See the Cummins Owners Manual for a description of fault codes.



**Faults**

The fault information box displays the fault icon with the fault number, date, and time of day listed in the order they occurred.

When one or more faults are enabled, an alarm turns on.

The yellow alert symbol displays on the active screen if a fault occurs. Go to the Information screen to identify the fault.

When the fault information box is selected, the screen scrolls through the current faults one icon at a time.

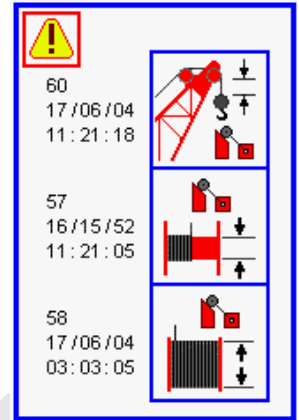
The fault history allows review of past faults. To view past faults, press the enter button to access level 2. Use the select buttons to view the fault history. Press the exit button to exit the fault screen.

Table 3-3 lists the faults that can appear in the fault screen. Some of the fault items shown may not be on your crane.

Faults indicated with an asterisk (\*) will stop crane operation in the direction of the fault—**Take corrective action to continue crane operation.**

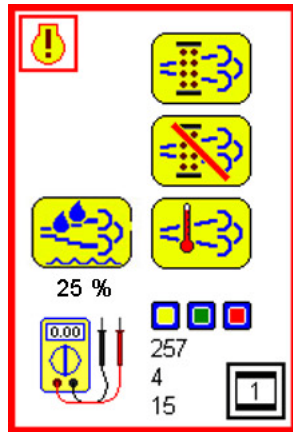
**Engine Prompt**

The yellow engine alert symbol displays if a Cummins engine fault occurs. Go to the information screen to determine the fault.



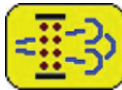
**Engine Faults and Information**

The engine fault screen displays Tier 4 engine faults related to the exhaust aftertreatment system and faults generated by the Cummins engine control module. Tier 4-related faults are the following:



**Exhaust System Regen**

The exhaust system regen icon displays one of three conditions:



- If the exhaust system regen fault is steady on, the exhaust aftertreatment system requires a regeneration within the next few hours. Use the regen switch to manually start a regeneration cycle.
- If the exhaust system regen fault is flashing, the aftertreatment system is in regeneration mode. The crane may reduce in power. This fault does not require immediate action.
- If the exhaust system regen fault is flashing and the red light is on, regeneration is required but is inhibited. The crane will reduce engine power significantly. Turn off the regeneration inhibit switch and perform a manual regeneration immediately.

**Exhaust System Regen Inhibited**

The exhaust system regen inhibited icon indicates the aftertreatment system active (automatic) regeneration is prevented because the inhibit switch is in the Inhibit position.



**CAUTION**

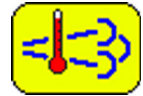
**Aftertreatment System Damage**

Do not place the inhibit switch in the inhibit position unless directed by a Manitowoc or Cummins technical advisor.

If aftertreatment system regeneration is prevented for an extended period, the system will become damaged and components will require replacement.

Inhibiting regeneration may cause loss of engine power or shutdown by the ECM and the need to service or replace the affected module.

**High Exhaust System Temperature (HEST)**



The high exhaust system temperature icon indicates that exhaust temperatures are higher than normal, typically due to normal aftertreatment system regeneration. It is normal for this indicator to come on.

**WARNING**

**High Exhaust Temperatures**

Clear personnel from any exhaust areas to prevent injury. Active aftertreatment system regeneration can occur at low engine idle and during crane operation, resulting in a high exhaust temperature.

**DEF Tank Level**  
**DEF Tank Level Low**



The percentage of DEF remaining in the DEF tank displays below the DEF tank level icon.

25%

The DEF tank level low icon displays if the level of diesel exhaust fluid (DEF) in the tank is low:

- At 10% DEF left in the tank, the icon will display
- At 5% DEF left in the tank, the icon will flash

**WARNING**

**Chemical Hazard**

Keep DEF from getting in any eyes. The DEF contains urea. In the case of eye contact, immediately flush the eyes with large amounts of water for at least 15 minutes.

Do not ingest DEF. If DEF is ingested, contact a physician immediately.

**CAUTION**

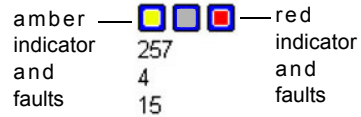
**DEF Deterioration Hazard**

Do not store DEF for long periods of time. The DEF will deteriorate relative to time and temperature. Low-quality DEF may require the tank to be drained and the system to be purged.

For more information on the exhaust aftertreatment system, see Section 7 of the service manual.

**Fault Level Indicators**

If a fault level indicator is on, address an active engine fault immediately:



- Amber warning—service immediately
- Red stop—service immediately. Engine derate or shutdown may be imminent

**NOTE:** The center indicator has no assigned function.

The active Cummins ECM fault codes are under the indicator. See the engine owners manual for a description of these fault codes.



**Engine Loss of Power or Shutdown Hazard**

Address any active engine faults immediately if the amber warning light is on to prevent the engine ECM from reducing engine power.

Address any active engine faults immediately if a red fault indicator is on. The ECM will soon command the engine to lose power, reduce speed, or shut down.

The following conditions cause an amber or red indicator to come on and allow a limited time to operate the engine at full power:

- Low DEF level
- Low DEF quality
- SCR malfunction

**NOTE:** The following time limits are approximate.

**Low DEF level—Amber:** This warning indicates the level of DEF in the tank is 2.5%. The ECM will reduce engine power and speed.

If the level falls to 0%, the ECM will reduce engine power further after 30 minutes.

**Low DEF level—Red:** This warning indicates the level of DEF in the tank has been 0% for 30 minutes.

The engine will continue to operate at reduced power and speed for another 30 minutes. After 30 minutes the ECM will shut the engine down.

**Low DEF quality—Amber:** This warning indicates the DEF in the tank is of poor quality. If not corrected, the ECM will reduce engine power and speed after 150 minutes. After 75 minutes, the ECM will then reduce engine power further. After 15 minutes, the red indicator will turn on.

**Low DEF quality—Red:** This is the final DEF quality warning. If the problem is not corrected, the ECM will reduce engine power and speed for 30 minutes. After 30 minutes, the ECM will shut the engine down.

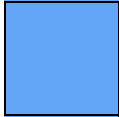

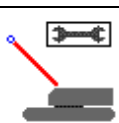

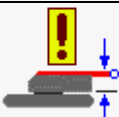



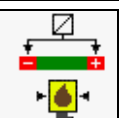
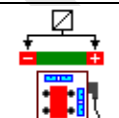
**SCR Malfunction or Tampering—Amber:** This warning indicates a problem with the SCR. If not corrected, the ECM will reduce engine power and speed after 150 minutes. After 75 minutes, the ECM will then reduce engine power further. After 15 minutes, the red indicator will turn on.

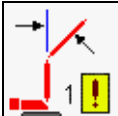
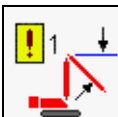


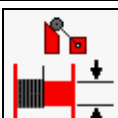
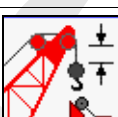
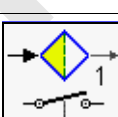
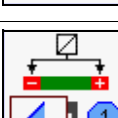
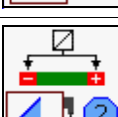
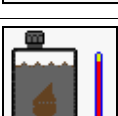
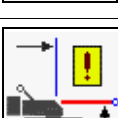
For information on possible causes, see Section 7 of the 16000 Service Manual.

**SCR Malfunction or Tampering—Red:** This is the final SCR malfunction warning. If the problem is not corrected, The ECM will reduce engine power and speed for 30 minutes. After 30 minutes, the ECM will shut the engine down.

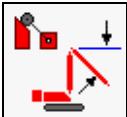
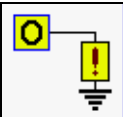
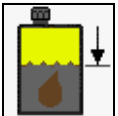
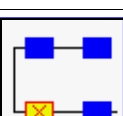
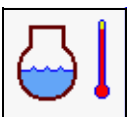

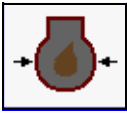
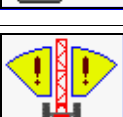

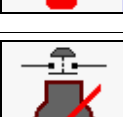



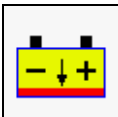


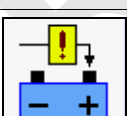
**NOTE:** This only a partial list of engine ECM faults.

Table 3-3. Faults

Item	Description
	0-No Fault.
	4-Out of Level—Indicates the crane is approximately 3° to 4-1/2° out of level while jacking upperworks with setup remote control.
	6-Setup Mode—Indicates setup mode is on (Liftcrane Mast Capacities Chart selected in configuration screen of RCL or luffing jib setup mode, if applicable, is on.)
	10-Engine Fault*—See the engine data box on the Information screen. See the Engine Owner's Manual for diagnostics fault codes.
	13-Mast 2 Degree Fault*—Indicates the live mast has reached hand-help wireless remote angle and stops downward movement of the live mast when lowering the live mast to transport position. Complete mast lowering manually with the hand-held wireless remote.
	27-Mast Stop Retracted*—Indicates the MAX-ER lift and boom hoist up will be disabled. This fault cannot be bypassed. This fault will also activate if Node-6 electric cables are not connected properly.
	30-Hydraulic Fan—Indicates a short in the fan circuit or the pressure senders (transducers) are out of range. Fault 41 (Transducer Voltage) or Fault 84 (Digital Output Disable) will light at the same time, indicating the problem.
	34-Function Parked*—Indicates a function is inoperable because it is parked. Turn the indicated park switch off or sit down in the seat.
	41-Transducer Voltage—Indicates a pressure transducer is not within the allowable range, high or low.
	43-Out of Level Sensor—Indicates the crane is approximately 4-1/2° out of level while jacking the upperworks with the ALL switch on the setup remote control. Relevel crane with the individual jacking switches on the remote control.

Item	Description
	49-Jib Maximum Up 1* — Indicates the jib is at the maximum working angle and stops the luffing jib. Lower the luffing jib. Limit can be bypassed to raise the jib to the Maximum Up 2 limit.
	50-Jib Maximum Down 1*—Indicates the jib is at the maximum down position and activates the fault alarm. Operation does not stop. Luffing jib may be lowered an additional 3° to the Luffing jib maximum down 2 limit (67).
	54-Rated Capacity Indicator/Limiter*—Indicates the crane is at the rated capacity limit and stops all drums. Land the load or raise the boom/jib.
	55-Boom Up*—Indicates the boom is in the maximum up position and stops the boom from raising. Lower the boom.
	57-Minimum Bail*—Indicates the bail is in the minimum position and stops the displayed drum from lowering. Move the drum the up direction.
	60-Block Up Limit* —Indicates the load is at the block-up limit and stops load drum and boom. Lower the load or raise the boom.
	61-Filter 1/62-Filter 2—Indicates the filter is dirty or plugged. Replace the element or clean the filter.
	63-Boom Angle Sensor—Indicates the boom angle sensor is out of normal range (0.15 to 4.85 Volts).
	64-Jib Angle Sensor—Indicates the luffing jib angle sensor is out of normal range (0.15 to 4.85 Volts).
	65-Hydraulic Fluid Temperature—Indicates the fluid temperature in the hydraulic tank is below 18°C (65°F) or above 82°C (180°F).
	66-Mast Too Far Forward*—Indicates the live mast is below 156°. Raise the live mast. Further lowering may cause <b>mast to fall</b> .



Item	Description	Item	Description
	67-Jib Maximum Down 2*—Indicates the luffing jib is at the minimum angle and stops the jib. Raise the luffing jib.		84-Digital Output Disabled—Indicates the digital output signal has a short circuit between the computer node and output device. See the CAN Bus screen or Diagnostic screen information to identify the problem component.
	69-Hydraulic Reservoir Level—Indicates the hydraulic oil is at the <b>caution low level</b> indicated on tank gauge. Fill the tank.		85-CAN Communication—Indicates one or more computer nodes are not communicating correctly. See the CAN Bus screen to identify the node(s).
	70-Engine Coolant Temperature—Indicates the engine coolant temperature is above 96°C (205°F).		86-Boom Range Limiter*—Indicates the up or down range limiter is tripped. Move the boom up or down away from the limit.
	71-Engine Oil Pressure—Indicates the oil pressure is below 0.5 bar (7.25 psi).		87-Swing Range Limiter*—Indicates the right or left range limiter is tripped. Swing the rotating bed away from the limit.
	73-Jib Maximum Up 2* — Indicates the luffing jib is at the maximum angle and stops the jib. Lower the luffing jib. This limit cannot be bypassed.		88-Engine Shutdown*—Indicates the remote emergency stop shut down switch is pushed. Pull the switch up to reset it and allow the engine to start.
	75-Low Fuel Level—Indicates less than five percent fuel remains in the tank. Fill the tank as soon as possible to prevent engine stoppage.		89-Super Charge Pressure— Indicates the pressure switch that monitors hydraulic fluid to the main pumps is open.
	77-Mast System—Indicates the boom/mast hoist is inoperable in both directions. Determine the cause and correct it.		
	78-Battery Low—Indicates the battery voltage is below 18 volts. Determine the cause and correct it.		
	80-Invalid Configuration*—Indicates the load drums are not configure correctly. Make sure the selected RCL configuration for load drums is correct.		
	81-Wireless System—Indicates the wireless load link senses a fault. See the wireless link information in the Rated Capacity Indicator/ Limiter manual.		
	83-Alternator—Indicates the engine alternator is not generating a charge to the battery.		

### Diagnostic Screen

The diagnostic screen shows the hydraulic circuit and the status of all pumps, motors, valves, and switches that apply to the crane function selected.

This view-only screen operates on two levels:

**Level 1**— Displays the full crane. Use the select buttons to highlight individual crane functions.

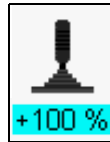
**Level 2** — Displays the diagnostic screen for the highlighted crane functions.

The yellow alert symbol displays if a system fault occurs. Go back to the Information screen to identify the fault.

#### Diagnostic Screen Component Icons

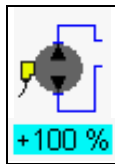
##### Control Handle

Displays the system control handle command in percent from neutral. Drums display +raise and – lower. Swing displays +right and –left. Travel displays +forward and –reverse.



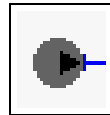
##### Variable Closed-Loop Pump

Displays the pump command in percent from neutral for drums, swing, and travel.



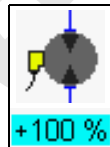
##### Gear Pump

Displays an accessory pump or system charge pump.



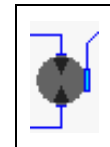
##### Variable Closed-Loop Motor

Displays the motor command with 0% maximum displacement and 100% minimum displacement.



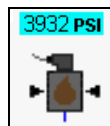
##### Closed Loop Variable Motor with Remote Pilot

Displays the two-speed motor with a remote pilot, used for shifting motor speeds automatically when selected.



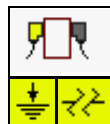
##### System Pressure Sender

Displays the hydraulic pressure (psi/bar).



##### DIN Electrical Connector

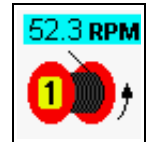
The DIN electrical connector changes to yellow when the selected item is enabled. If the ground or open circuit icon is yellow, there is a circuit fault that shall be serviced immediately.



**NOTE:** Variable outputs may show the icon at all times.

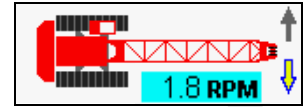
##### Drum Speed

Displays drum direction and speed in revolutions per minute (RPM).



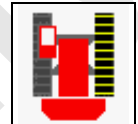
##### Swing Status

Displays swing direction and speed in revolutions per minute (RPM). The yellow arrow indicates swing direction.



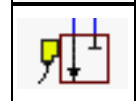
##### Track Symbol

Displays track status. A track is operating when the corresponding track on the icon is yellow.



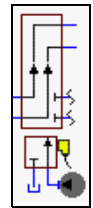
##### Valve Status

Displays the valve status.



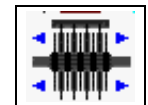
##### Pilot Valve

Displays the external piloted valve status.



##### Disc Brake

Displays disc brake status as either applied or released (shown).



##### Drum Pawl

Displays pawl status as either engaged or disengaged (shown).



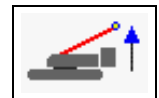
##### Mast Angle

Displays the mast angle in degrees above the transport position.



##### Mast Raise Status

Displays the command state of the mast raise cylinders.



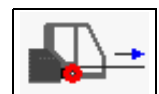
##### Cab Tilt Status

Displays the command state of the cab tilt cylinder as either up/out or down/in (shown).



##### Rigging Winch Status

Displays the command state of the rigging winch as either haul in or pay out (shown) line.



**Counterweight Pin Status**

Displays the command state of the counterweight pin cylinders as either extended (shown) or retracted.



**Boom Hinge Pin Status**

Displays the command state of the boom hinge pin cylinders as either extended (shown) or retracted.



**Rotating Bed Pin Status**

Displays the command state of the rotating bed pins as either extended or retracted (shown).



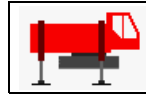
**Engine Cooling Fan Status**

Displays the command state of the engine cooling fan as either on (shown) or off.



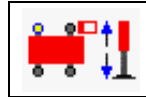
**Crane on Jacks Symbol**

Displays the crane on jacks. The diagnostic screen also displays a front view icon.



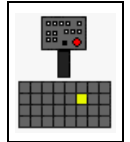
**Jack Status**

Displays the command state of a jack cylinder. The left rear jack is shown extended.



**Remote Control: Wireless and Wired**

Displays the remote control status by indicating which switches are closed.



Each control switch corresponds to a number (see [Table 3-4](#)). Switch numbers 1 through 8 are in row one, 9 through 16 are in row two, 17 through 24 are in row three and 25 through 32 are in row four. Not all switch numbers are used. Switch number 14 (Left Front Jack - Extend) is enabled in the example shown.

**Table 3-4 Wireless Remote Switch Identification**

No.	Description	No.	Description
1	Engine Low Speed	16	Right Front Jack - Extend
2	Engine High Speed	17	Left Rear Jack - Retract
7	Boom Pins - In	18	Left Rear Jack - Extend
8	Boom Pins - Out	19	Right Rear Jack - Retract
9	Front Adapter Pins - In	20	Right Rear Jack - Extend
10	Front Adapter Pins - Out	21	All Jacks - Retract
11	Rear Adapter Pins - In	22	All Jacks - Extend
12	Rear Adapter Pins - Out	24	Counterweight Pins - Out
13	Left Front Jack - Retract	25	Mast Lower
14	Left Front Jack - Extend	26	Mast Raise
15	Right Front Jack - Retract	27	Remote Stop

Reference

**Drum Diagnostic Screens**

Select the drum icon on screen level 1 as shown in [Figure 3-37](#). Press the enter button to go to level 2.

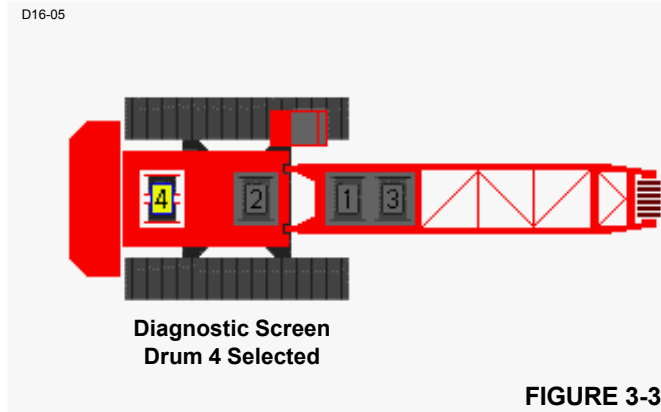


FIGURE 3-37

In the drum example shown in [Figure 3-38](#), drum 4 is hoisting up. Drum 4 shares a single pump with drum 5 connected through a diverting valve. A second pump could also power drum 4 connected to the left track through an upper diverting valve.

**NOTE:** The mast hoist drum 5 is only selected when the crane is configured with a MAX-ER.

For load drums 1 or 2, the drum 2 pump is dedicated to the drum 1 motor through a diverting valve when drum 1 is selected. The drum 2 pump is dedicated to the drum 2 motor when drum 2 is selected. Both drums can be operate at the same time at half speed.

For load drum 3, the left travel pump is dedicated to operate the drum 3 motor through a diverting valve when drum 3 is selected. Drum 3 is inoperable when traveling. Drum 3 can be a load drum or luffing drum.

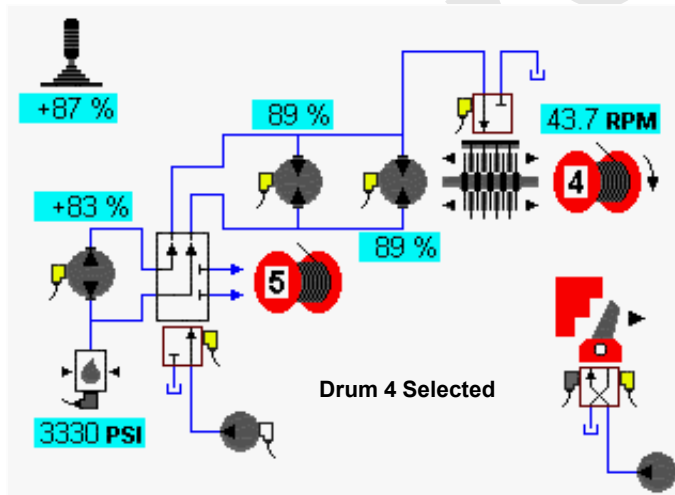


FIGURE 3-38

**Swing Diagnostic Screen**

Select the swing icon on screen level 1 as shown in [Figure 3-39](#). Press the enter button to go to level 2.

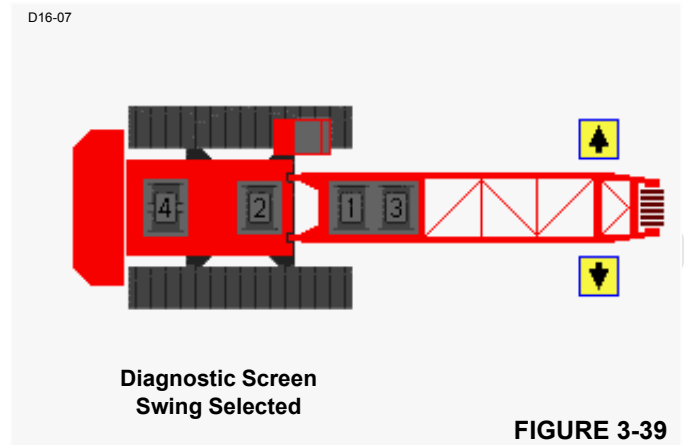


FIGURE 3-39

[Figure 3-40](#) displays swing system icons. The example shows the swing function at rest. A circular arrow symbol near each pressure sender indicates which sender monitors swing right and left pressures. The third sensor on the far left monitors the swing brake pressure.

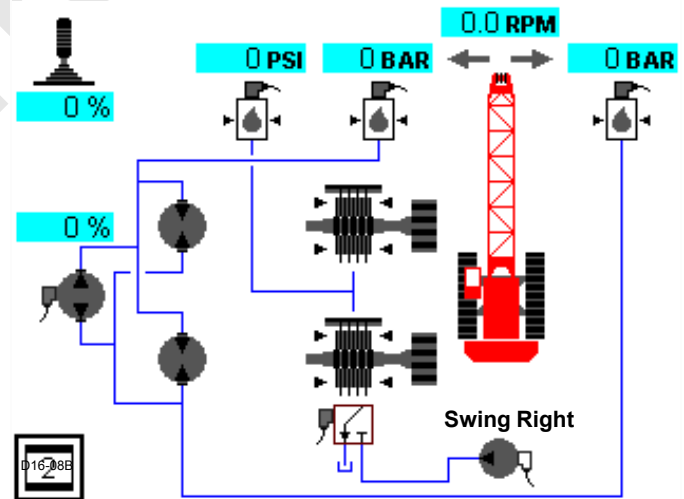
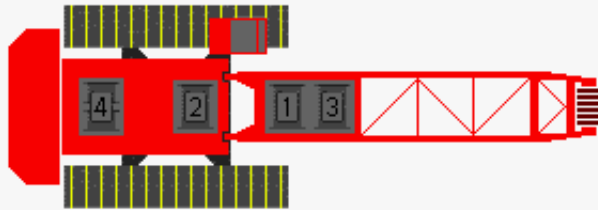


FIGURE 3-40

**Travel Diagnostic Screen**

Select the travel icon on screen level 1 as shown in [Figure 3-41](#). Press the enter button to go to level 2.

D16-09

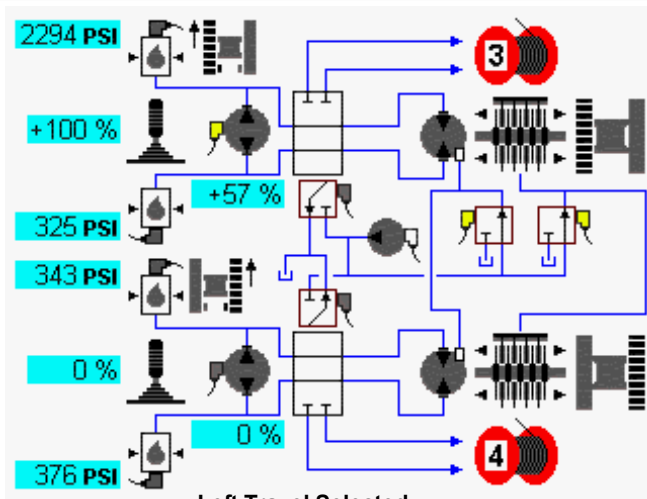


Diagnostic Screen  
Travel Selected

FIGURE 3-41

In the travel system example shown in [Figure 3-42](#), the left travel pump is dedicated to operate drum 3 through a diverting valve if drum 3 is selected. Under certain conditions, if drum 4 is selected and drum 5 is also configured, the right travel pump is dedicated to operate drum 4 through a diverting valve.

**NOTE:** When crane travel is enabled, drum 3 is disabled.



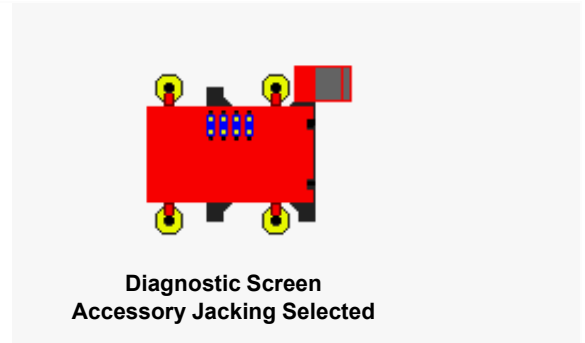
Left Travel Selected

D16-10B

FIGURE 3-42

**Jacking Accessory Diagnostic Screen**

Select the crane carbody with jacking icon in screen level 1 as shown in [Figure 3-43](#). Press the enter button to go to level 2.

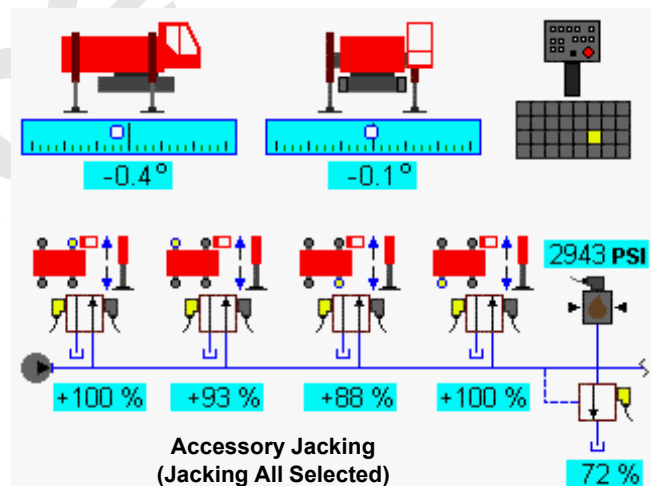


Diagnostic Screen  
Accessory Jacking Selected

D16-11

FIGURE 3-43

The jacking accessory diagnostic screen displays the component icons shown in [Figure 3-44](#). In the example, the All switch on the wireless remote is selected. The crane on jacks icons indicate crane level in the front-to-back and side-to-side directions.



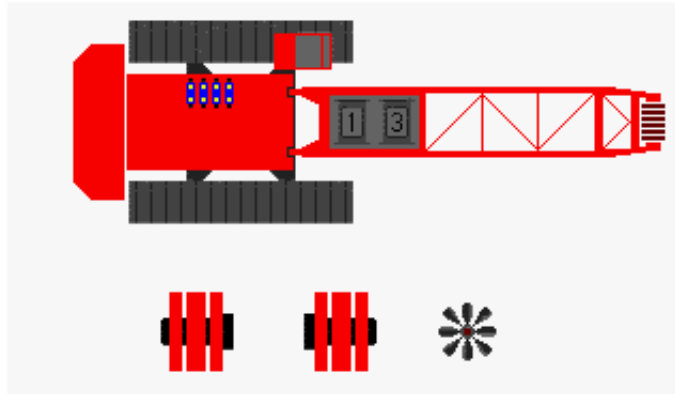
Accessory Jacking  
(Jacking All Selected)

D16-12

FIGURE 3-44

**Pins and Fan Accessory Diagnostic Screen**

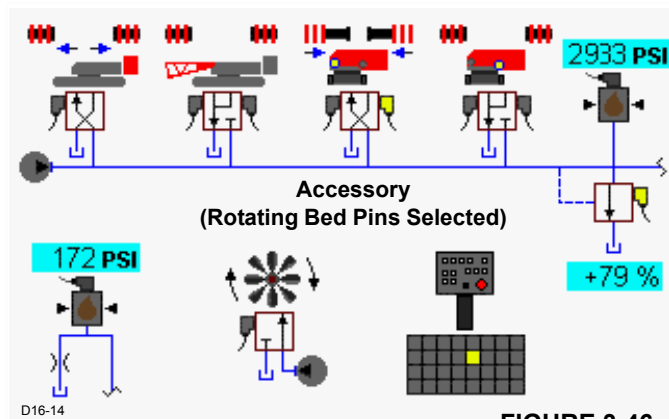
Select the crane, pins, and engine fan icon on screen level 1 as shown in [Figure 3-45](#). Press the enter button to go to level 2.



D16-13

FIGURE 3-45

See [Figure 3-46](#) for an example of the counterweight pins, boom hinge pins, front/rear rotating bed pins, and engine fan screen. In the example, the left front rotating bed pin on the wireless remote is selected. The example also shows the engine fan status.

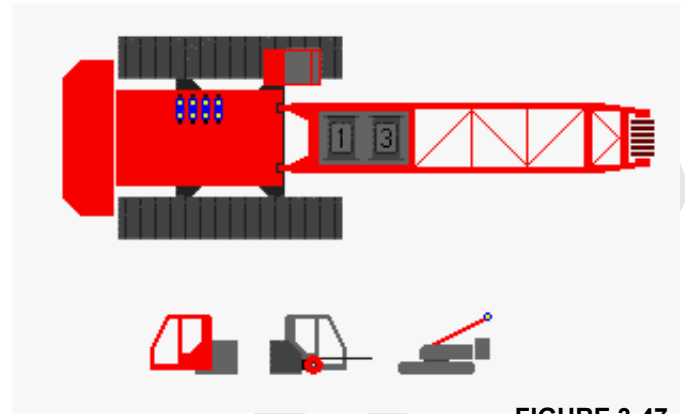


D16-14

FIGURE 3-46

**Cab Tilt, Rigging Winch, and Mast Accessory Diagnostic Screen**

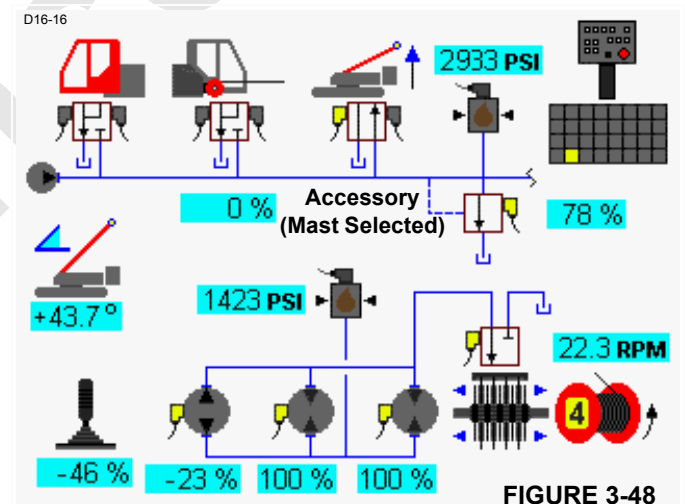
Select the cab tilt, rigging winch, and mast icon on screen level 1 as shown in [Figure 3-47](#). Press the enter button to go to level 2.



D16-15

FIGURE 3-47

See [Figure 3-48](#) for the cab tilt, rigging winch, and mast raising cylinders screen. In the example, the mast raising cylinders in the up direction are selected on the wireless remote.



D16-16

FIGURE 3-48

**MAX-ER Diagnostic Screen**

If equipped with a MAX-ER, select the MAX-ER icon on screen level 1 and press the enter button to go to level 2. See the MAX-ER Operator Manual for complete MAX-ER attachment information.

### Function Mode Screens

See [Figure 3-49](#) for following procedure.

The Function Mode screen enables and disables modes and sets operating parameters for individual crane functions. This screen operates on four levels:

**Level 1**—Displays the full crane. Use the select buttons to highlight individual crane functions.

**Level 2**—Displays the function mode screen for the highlighted crane function. The selected mode or limit data box is highlighted blue. Use the select buttons to choose a mode or limit data box.

**Level 3**—Displays the selected mode or limit data box highlighted red. Use the select buttons to enable or disable a mode or to set a limit.

**Level 4**—Displays the selected mode or limit data data box highlighted green. Use the select buttons to adjust the value shown in the data box.

To enable or disable modes or to set operating parameters for individual crane functions, use the following:

1. Press the enter or exit buttons as required to go to level 1. Use the select buttons to highlight the desired crane function.
2. Press the enter button to go to level 2. Use the select buttons to choose the mode or limit data box to access. Press the enter button to go to level 3.
3. Use the select buttons to enable or disable a mode or to adjust an operational parameter.
4. If required, press the enter button to go to level 4. Use the select buttons to adjust the operational parameter.
5. Press the exit button as required to return to a previous level or to the Menu screen.

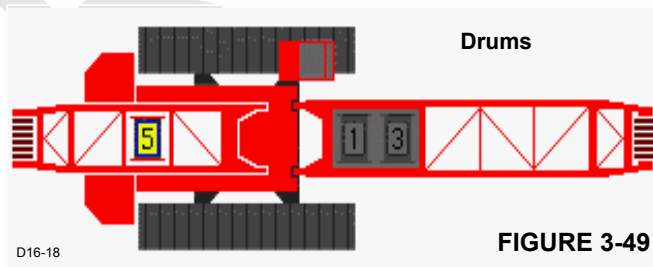
The yellow alert symbol displays if a system fault occurs. See the Information screen to access faults.

On (1) and off (0) icons in some data boxes indicate the electrical status of an item.



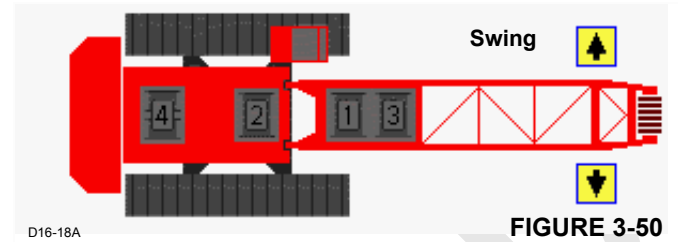
### Drum Functions

Select drum functions 1 through 5 from the screen shown in [Figure 3-49](#).



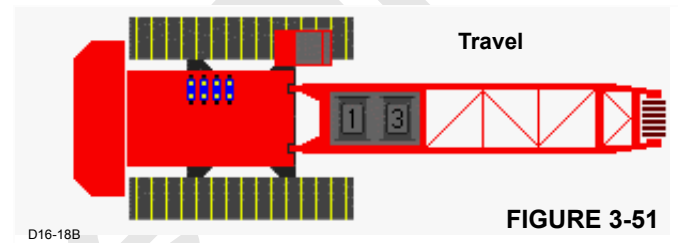
### Swing Functions

Select swing functions from the screen shown in [Figure 3-50](#).



### Travel Functions

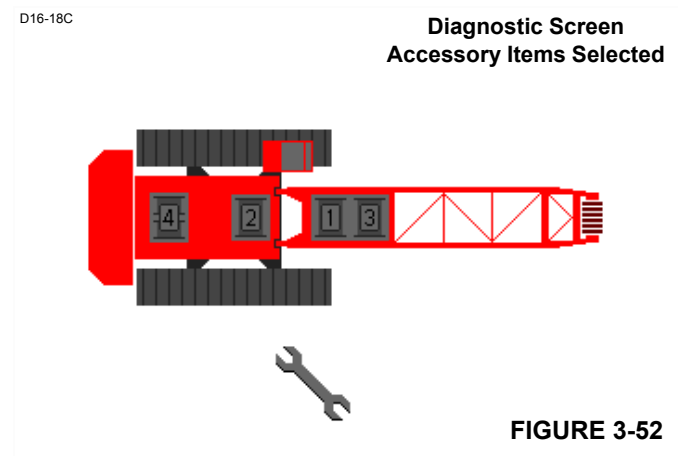
Select travel functions from the screen shown in [Figure 3-51](#).



### Setup Functions

At the function select screen, scroll until the wrench icon appears ([Figure 3-52](#)). Then press the enter button to bring up the setup function screen.

To turn the crane setup remote control on, see the procedure under the Crane Setup Remote Controls topic on [page 3-38](#).



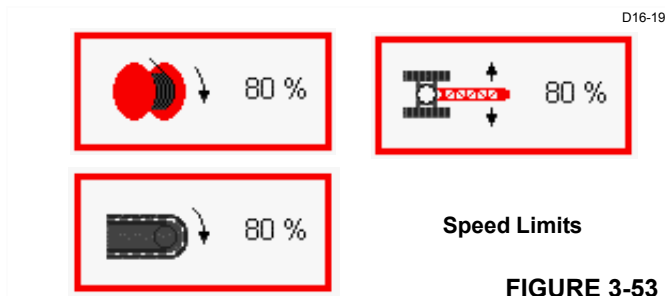
### MAX-ER Functions

Select MAX-ER functions from the MAX-ER attachment screen. See the MAX-ER Operator Manual for complete MAX-ER attachment information.

**Drum, Swing or Track Speed Limits**

See [Figure 3-53](#) in following procedure.

Level 3 includes drum, swing, and crawler speeds limits. Adjust the value in these data boxes with the select buttons to limit the function speed between 25% and 100% of maximum capability.



**Swing Pressure Limit**

See [Figure 3-54](#) in following procedure.

Level 3 includes a swing pressure limit. Adjust the value in this data box with the select buttons to limit swing pressure between 25% and 100% of maximum capability.



**Rigging Winch Mode**

See [Figure 3-55](#) in following procedure.

Level 3 includes the rigging winch mode setting. Use the select buttons to enable or disable the rigging winch for the selected drum function. The rigging winch mode data box (shown disabled) will not appear in the function mode screen unless this feature is available.

When the rigging winch is enabled, the computer selects control handle (selected handle display light is 0). If the rigging winch is enabled for drum 4, the computer selects a load drum handle to control the winch.

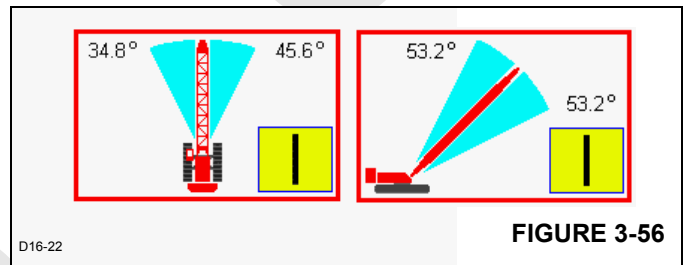


**Boom or Swing Motion Limiter Mode**

See [Figure 3-56](#) in following procedure.

**NOTE:** Motion limiter mode data boxes do not appear unless the crane has this option.

On level 3, use the select buttons to enable or disable the motion limiter mode. When in level 3 with the motion limiter mode enabled, the controller monitors and stores the maximum right/left or up/down angles during operation. After exiting level 3, these angles limit boom or swing motion.



**Pressure Test and Calibration Screen**

Use the Pressure Test and Calibration Screen to initiate and monitor hydraulic test and calibration procedures. For instructions, refer to Section 2 of the Service Manual.

**Camera Screen (Optional)**

The camera screen (not shown) displays camera options and selects and operates items. The camera option includes up to three cameras to monitor drum spooling and the area behind the crane. For more information, refer to the camera option documentation supplied in the crane manual package.

**CAN Bus Screen**

The CAN (Controller Area Network) bus diagnostic screen is for technicians. For instructions, refer to Section 2 of the Service Manual.



## WIND CONDITIONS

Wind adversely affects lifting capacity and stability. The result could be loss of control over load and crane, even if load is within the crane's capacity.

**See the Wind Conditions document at end of this section or in the Capacity Charts Manual provided with crane and attachments.**



### WARNING

#### Tipping Crane Hazard

Judgment and experience of qualified operators, job planners, and supervisors shall be used to compensate for the affect of wind on the lifted load and boom by reducing ratings or operating speeds, or a combination of both.

Failing to observe this precaution can cause the crane to tip or the boom and/or jib to collapse. Death or serious injury to personnel can result.

Wind speed (to include wind gusts) shall be monitored by job planners and supervisors.

The wind speed at boom or jib point can be greater than wind speed at ground level. Also be aware that the larger the sail area of the load, the greater the wind's affect on the load.

As a general rule, the ratings and operating speeds must be reduced when:

***Wind causes load to swing forward past allowable operating radius or sideways past either boom hinge pin.***

## PREPARATION FOR COLD WEATHER

### Crane Limitations

The static load carrying limitations of the steels used in Manitowoc cranes is not affected by cold weather. Manitowoc's capacity charts are acceptable for use in cold weather.

Dynamic loads (impact and shock) can affect the steels used in Manitowoc cranes when operating in cold weather. Dynamic loads are created by traveling, sudden application and release of load, and duty-cycle operations.



### DANGER

#### Injury and Equipment Failure Hazard

At low ambient temperatures, dynamic loads (impact and shock) can result in structural failure leading to serious injury or death.

When operating in ambient temperatures of  $-20$  to  $-30^{\circ}\text{C}$  ( $-5$  to  $-22^{\circ}\text{F}$ ), use the following precautions:

- Avoid impact or shock-loading of the crane and any attachment.
- Conduct operations with regard to potential failure of hydraulic components.

When operating in ambient temperatures of  $-31$  to  $-40^{\circ}\text{C}$  ( $-23$  to  $-40^{\circ}\text{F}$ ), use the following precautions:

- De-rate crane by 40% for all lift operations. Halting all lifts should be considered.
- Duty-cycle operation is prohibited.

When operating in temperatures below  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ), use the following precautions:

- All operation (lift and duty-cycle) is prohibited except in extreme emergencies, and then only with approval from a competent engineer who has de-rated crane accordingly.

### Wire Rope

Wire rope lubrication may be a problem during extreme cold weather as normal wire rope lubricants may harden and chip off.

Consult your wire rope supplier for recommended cold weather lubricants.

### Gear and Hydraulic Oil

For recommended hydraulic oils to use during cold weather, refer to the Lubrication Guide which is supplied with this manual.

### CAUTION

#### Avoid Hydraulic Component Damage

Heat the hydraulic oil to at least  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) prior to startup. Tank heaters are available from Manitowoc.

## ENGINE START PREPARATION

### Cooling System Heater

An engine block (coolant) heater is installed on the engine. The heater uses an electric heating element to heat the coolant inside the engine when crane is idle.

When the Manitowoc Cold Weather Package (see Page 3-58) is installed, this heater is connected to a central circuit breaker panel (Page 3-59). This can be installed by your Manitowoc dealer.

**Engine heater shall be unplugged when engine is running to prevent cooling system from overheating.**

### Cooling System Antifreeze

The cooling system shall be kept full and be protected from freezing at the lowest expected ambient temperature. See the Cummins engine manual for antifreeze recommendations.

A mixture of 40% antifreeze and 60% water provides freeze protection to  $-37^{\circ}\text{C}$  ( $-35^{\circ}\text{F}$ ). A mixture of 60% antifreeze and 40% water provides freeze protection to approximately  $-51^{\circ}\text{C}$  ( $-60^{\circ}\text{F}$ ). 100% antifreeze will freeze at  $-23^{\circ}\text{C}$  ( $-10^{\circ}\text{F}$ ).

### Diesel Exhaust Fluid (DEF)

The DEF is kept heated by engine coolant which is circulated through a heat exchanger in the tank.

DEF will begin to crystalize and freeze at  $-11^{\circ}\text{C}$  ( $12^{\circ}\text{F}$ ) and when frozen will expand by 7%. There are no approved additives to improve the freezing point.

Keep the DEF tank at least 50% full. The DEF tank holds 15 gallons of DEF.



### WARNING

#### Chemical Hazard

The DEF contains urea. Do not get DEF in any eyes. In the case of contact, immediately flush the eyes with large amounts of water for a minimum of 15 minutes. Do not ingest the DEF. In the event the DEF is ingested, contact a physician immediately.

## COLD WEATHER HEATER PACKAGE

The optional cold weather package is a 240 volt AC single phase power supply with heaters. The heaters preheat critical machinery and lubricant sumps during cold weather shutdown.

The package includes a 240 volt receptacle and circuit breaker panel mounted on the rear of the cab (see [Figure 3-57](#)).

When operated in an arctic climate — outside temperature continuously below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) and  $-34^{\circ}\text{C}$  ( $-30^{\circ}\text{F}$ ) — the crane should be equipped with the heaters identified in this section and lubricated with the lubricants listed in Section 5.

### CAUTION

#### Machinery Damage!

Operating in an arctic climate without heaters can damage machinery during cold weather startup due to lack of lubrication.

The heater package described in this section may not provide adequate protection when operating below  $-34^{\circ}\text{C}$  ( $-30^{\circ}\text{F}$ ). Contact your Manitowoc dealer for recommendations.

#### Hydraulic Pump Damage!

To prevent damage to pumps, warm the hydraulic oil to  $16^{\circ}\text{C}$  ( $60^{\circ}\text{F}$ ) minimum before operating the crane.

The package includes the following heaters:

- Engine coolant (4000 watt)
- Engine oil sump (300 watt)
- Hydraulic oil tank (2000 watt)
- Cab console (125 watt)
- Battery pad (two 75 watt, 240 volt)

### Turning Heaters On

To turn the heaters on, use the following:

1. Disconnect the external power supply.
2. Check that main circuit breaker and each heater circuit breaker is off (see [Figure 3-57](#)).
3. Check that external power supply source is off.



### WARNING

#### Electrocution Hazard!

Severe electric shock can cause death or serious injury. The crane owner/user shall make provisions for turning off the electrical power supply before connecting the power supply cord to the crane.

4. Connect the external power supply cord to the receptacle at the rear of the cab.
5. Turn on external power supply.
6. Turn on main circuit breaker.
7. Turn on each heater circuit breaker.

### Turning Heaters Off

To turn the heaters off, use the following:

1. Turn off main circuit breaker.
2. Turn off each heater circuit breaker.
3. Perform remaining steps only if power supply cord will be disconnected or electrical system is being serviced:
  - a. Turn off external power supply.

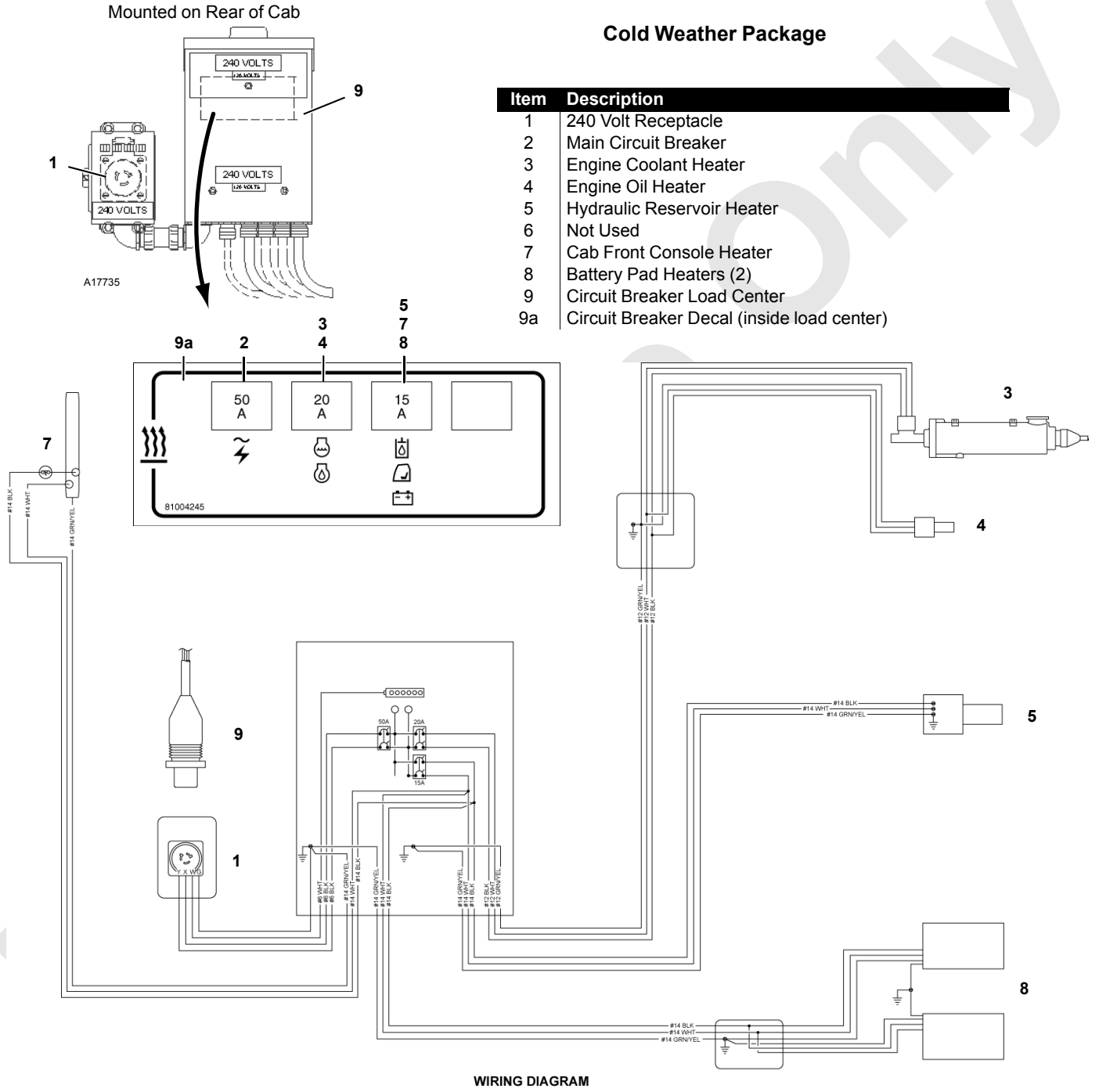
- b. Unplug power supply cord from crane.

### CIRCUIT BREAKERS

See Section 3 in the Service Manual for identification and location of circuit breakers used to protect crane's electric circuits.

### Cold Weather Package

Item	Description
1	240 Volt Receptacle
2	Main Circuit Breaker
3	Engine Coolant Heater
4	Engine Oil Heater
5	Hydraulic Reservoir Heater
6	Not Used
7	Cab Front Console Heater
8	Battery Pad Heaters (2)
9	Circuit Breaker Load Center
9a	Circuit Breaker Decal (inside load center)



WIRING DIAGRAM

FIGURE 3-57

81004428\_wire\_diagram

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## SECTION 4 SET-UP AND INSTALLATION

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## SECTION 4

### SET-UP AND INSTALLATION

#### RIGGING DRAWINGS

For boom and jib rigging drawings that apply to the crane, see the end of this section.

#### LIFTCRANE MAST CAPACITIES

Live mast lifting capacities are located at the end of this section.

#### OPTIONAL ATTACHMENTS

If applicable, instructions for optional attachments that apply to the crane are located at the end of this section.

#### GENERAL SAFETY

To prevent accidents that can result in death or injury during crane assembly and disassembly, comply with the following general safety information and with specific safety information contained in assembly and disassembly steps.



#### WARNING

##### Avoid Death or Serious injury!

Read and understand the setup and installation instructions in this section before attempting to assemble or disassemble the crane.



#### WARNING

##### Tipping/Overload Hazard!

Avoid tipping the crane over or collapsing the live mast:

- Assemble and disassemble the crane on a solid, level, uniformly supporting surface.
- Do not exceed the swing limits and mast lifting capacities given in [Table 4-2](#).
- Keep the crane level when operating the carbody jacks.



#### WARNING

##### Avoid Falling Off Crane and Boom!

It is necessary to climb onto the crane and boom during assembly and disassembly steps.

Use sturdy, owner-furnished ladders or an approved personnel hoist to gain access to areas that cannot be reached from the ladders or steps provided with the crane.



#### WARNING

##### Moving Parts/Pinch Points!

Avoid death or crushing injury during crane assembly and disassembly:

- Assembly personnel—take every precaution to prevent injury when working near moving parts.
- Maintain communication between the operator and assemblers to avoid accidents.
- Do not raise or lower the live mast until all personnel are off the crane.
- Keep unauthorized personnel clear of the crane.



#### WARNING

##### Falling Load Hazard!

To prevent lifting equipment from failing and the load from dropping, the crane owner/user shall verify the following prior to each lift:

- All lifting equipment (shackles, hooks, slings, blocks) has been properly maintained and is safe for use.
- All lifting equipment has a capacity greater than or equal to the load to be lifted.

#### CRANE ORIENTATION

The terms right, left, front, and rear used in this section refer to the operator's right, left, front, and rear sides when seated in the operator cab looking forward. The crawler pin handles are on the front of the carbody.

#### SELF-ERECTING EQUIPMENT

The crane is equipped with the following self-erect components for assembly and disassembly:

1. Carbody jacks with pads for lifting the crane onto and off the trailer. The carbody jacks are also used to raise the crane during crawler repositioning.
2. Hydraulically-actuated pins for connecting and disconnecting the crawlers to and from the carbody
3. Hydraulically-actuated arms for raising and lowering the live mast from and to the transport position
4. A live mast that serves as a boom to install the crane's crawlers, carbody counterweights, and boom butt, and to handle other components as required
5. A 41 t (45 UST) load block and 4-leg sling with hooks for handling parts.

## ASSIST CRANE REQUIREMENTS

An assist crane is required for handling and installing the following components:

- Crane (rotating bed) counterweight tray and boxes
- Catwalks and steps

See Section 1 for the weights of components.

## ASSEMBLY AND DISASSEMBLY NOTES

Experienced personnel trained in erection and operation of construction cranes shall assemble and disassemble the crane, boom, and jib.

Read and become thoroughly familiar with the instructions in the applicable capacity charts, in this section, and in the rigging drawings at the end of this section before attempting to assemble, operate, or disassemble the crane.

Contact your Manitowoc dealer for assistance if any procedure is not fully understood.

## ASSEMBLY AND DISASSEMBLY AREA

Select an assembly/disassembly area that has a solid, level, uniformly-supporting surface. Make sure the area is large enough to accommodate the crane and the selected boom length, movement of trucks with trailers, and movement of an assist crane.

Set the carbody jack pads on a flat, solid foundation that will support the load placed on them. See [Table 4-1](#); for loading requirements.

Do not set the carbody jack pads in holes, on rocky ground, or on extremely soft ground.

If necessary, use wood blocking or steel plates under the carbody jack pads to properly distribute loading. The wood blocking or steel plates must meet the following criteria:

- Free of defects
- Strong enough to prevent being crushed or bent
- Long and wide enough to prevent settling under load

Contact the Manitowoc Crane Care Lattice Team for ground bearing information.



**Table 4-1:  
Carbody Jacks Load Data**

Maximum load on each jack—55 792 kg (123,000 lb)
Jack pad diameter—610 mm (24 in)
Jack pad weight—45 kg (100 lb)

## ACCESSING PARTS



### WARNING

#### Avoid Falling Off Crane and Boom!

Some parts of the crane, boom, and jib cannot be reached from the ground. Falling from the crane at any height could cause serious injury or death.

Take the necessary precautions to prevent slipping or falling off the crane or boom during assembly, disassembly, maintenance, or other work.

Personnel shall be provided with approved ladders or aerial work platforms to access those areas of the crane, mast, boom, and jib that cannot be reached from the ground or from steps, ladders, catwalks, and platforms provided by Manitowoc.

Adhere to local, state, and federal regulations for handling personnel and personnel fall protection.

#### Do not use the top of the mast or boom as a walkway.

Optional boom ladders (stored in the first 12 m [40 ft] insert on the boom) are available from Manitowoc. If your crane has ladders, see the instructions later in this section.

## CRANE WEIGHTS

See Section 1 for the overall weight of the crane and individual weights of components.

## HANDLING COMPONENTS

The major components are equipped with lifting lugs which are identified in the assembly and disassembly steps.

When lifting lugs are not provided, use nylon lifting slings. If wire rope or chain slings are used, install protective covering (such as sections of rubber tire) between slings and component being lifted.

### CAUTION

#### Lacing Damage!

Ensure straps for boom inserts and top remain pinned and secured in the shipping position during handling and transportation unloading.

### CAUTION

#### Personal Injury or Property Damage!

Ensure the boom straps remain properly secured in the shipping position to the boom insert or boom top during transportation loading or unloading and assembly or disassembly of the boom. Straps could shift or fall resulting in personal injury or property damage if not properly secured.

*It is the owner/user's responsibility to ensure that all lifting slings, hooks, and shackles are in safe working order and capable of handling the loads applied to them.*

## RETAINING CONNECTING PINS

Connecting pins are retained in various ways:

- Snap pins
- Quick-release pins
- Cotter pins
- Keeper plates with cap screws and lock washers

Do not operate the crane until all connecting pins are installed and properly retained.

## PIN AND CONNECTING HOLE CLEANLINESS

To prevent dirt from damaging closely machined surfaces of pins and connecting holes:

- Thoroughly clean all pins and connecting holes.
- Apply a light coat of grease to all pins and connecting holes.

## HOSE AND CABLE CLEANLINESS

To prevent dirt from entering the hydraulic systems or from damaging the electric connectors:

- Thoroughly clean the hydraulic fittings and the electric connectors before connecting them.
- Thoroughly clean the dust caps before attaching them to hoses, tubes, or cables.
- Do not drag the hydraulic hose fittings, the hydraulic hoses, the electric cable connectors, or the electric cables on the ground.

**NOTE:** Apply a light coat of silicone lubricant to the threads of all dust caps, couplers, and connectors to help in preventing the threads from seizing.

### COLD WEATHER MAST OPERATION

The live mast, live mast cylinders, and live mast arms can be damaged when attempting to lower the live mast (to the rear) during cold weather.

Do not attempt to lower the live mast with the mast hoist during cold weather until the following steps have been performed:

- Warm the hydraulic oil to at least 16°C (60°F)
- Mast cylinders fully extended and retracted twice to fill the cylinders with warm oil

#### Component Identification

Item	Description
1	Live Mast
2	Handling Pendant (mast and boom butt)
3	Load Block—41 t (45 UST)
4	4-Leg Chain Sling
5	Operator Cab
6	Crawler Assembly
7	Rotating Bed Adapter Frame
8	Carbody
9	Carbody Jacks
10	Carbody Counterweight (both ends)
11	Live Mast Assist Arm (1 each side)
12	Rotating Bed
13	Boom Hoist
14	Crane (rotating bed) Counterweight
15	Boom Hoist Wire Rope

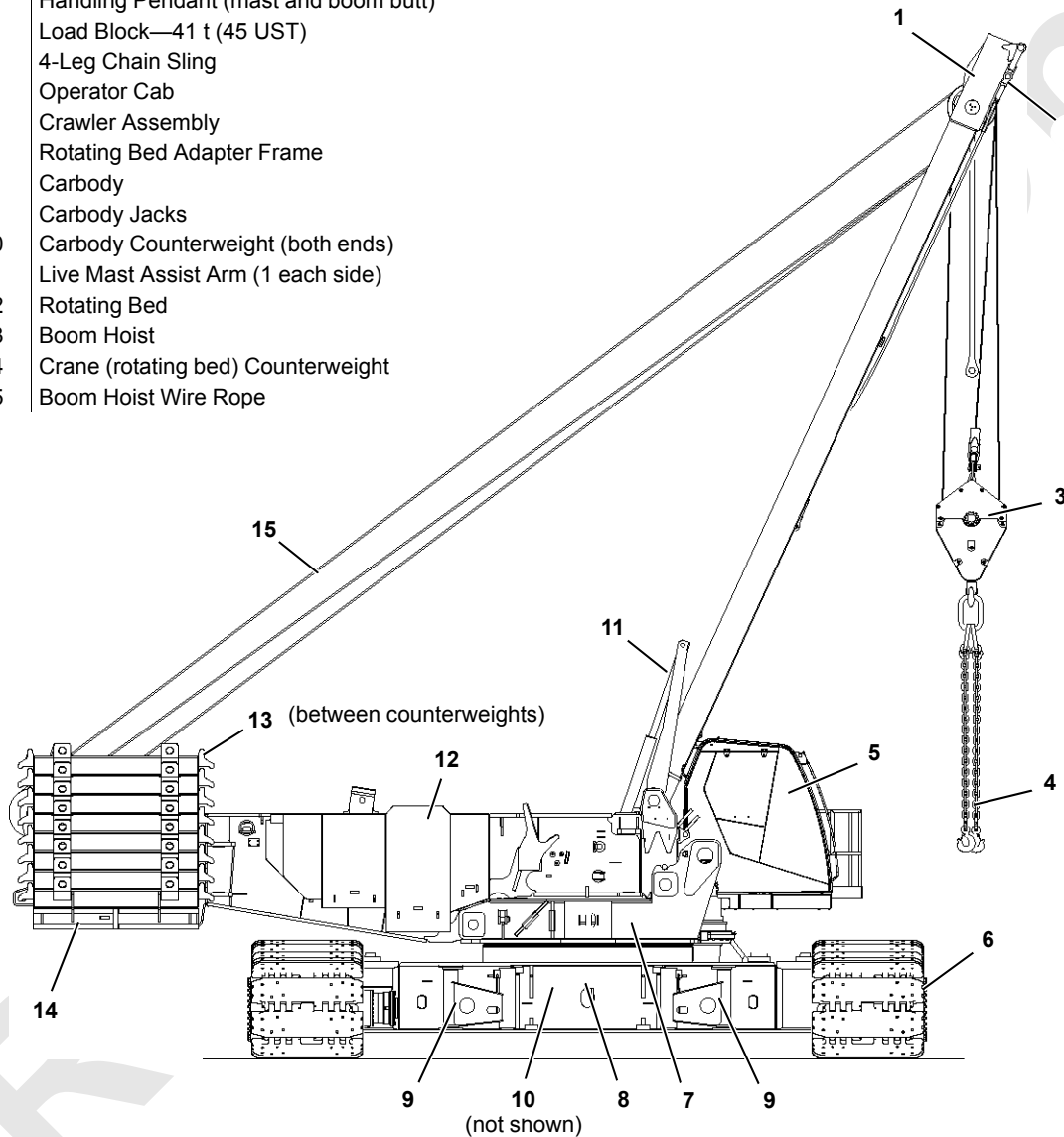


FIGURE 4-1

**Table 4-2:  
Operating Limitations**

See the *Liftcrane Mast Capacities Chart* at the end of this section for detailed lifting capacities.

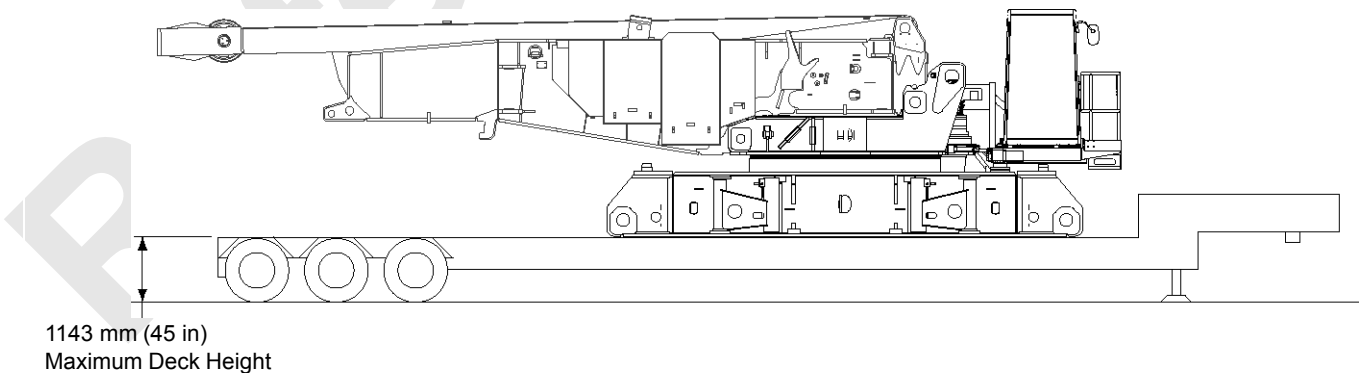
Crane Configuration	Swing	Max Capacity	Max Radius
<ul style="list-style-type: none"> <li>Crane on carbody jacks (rotating bed, adapter frame, and carbody)</li> <li>Live mast raised or lowered (NOTE 1)</li> <li>No assembly block</li> <li>No crawlers</li> <li>No counterweight</li> </ul>	<b>NO!</b>	Not applicable	
<ul style="list-style-type: none"> <li>Crane on carbody jacks (rotating bed, adapter frame, and carbody)</li> <li>Live mast in operating range (see <a href="#">Figure 4-8</a>)</li> <li>Assembly block installed (NOTE 2)</li> <li>No crawlers installed (handling 1st crawler)</li> <li>No counterweight</li> </ul>	10° Either Side of Center See <a href="#">Figure 4-9</a> , View E	34 019 kg (75,000 lb)	6,1 m (20 ft)
<ul style="list-style-type: none"> <li>Crane on carbody jacks (rotating bed, adapter frame, and carbody)</li> <li>Installing crawlers with mast</li> <li>No counterweight</li> </ul>	2nd Crawler Must be Lifted Over the <i>Opposite</i> Side of the 1st Crawler.		
<ul style="list-style-type: none"> <li>Crane on crawlers</li> <li>Counterweight installed or removed</li> <li>Handling loads with live mast</li> </ul>	360°		
<p><b>NOTE 1</b> Maximum mast angle = 156°  <b>NOTE 2</b> Chain sling and 3-part line required</p>			

4-2

**Rotating Bed/Adaptor/Carbody**

- Length 13,25 m (43 ft, 6 in)
- Width 3,0 m (9 ft, 10 in)
- Height 3,20 m (10 ft, 6 in)
- Weight 64 982 kg (143,261 lb)

4



**FIGURE 4-2**

## SHIPPING CRANE COMPONENTS

To ensure the crane's self-erecting system can load and unload the carbody and upperworks assembly, the trailer shall meet the specifications given in [Figure 4-2](#).

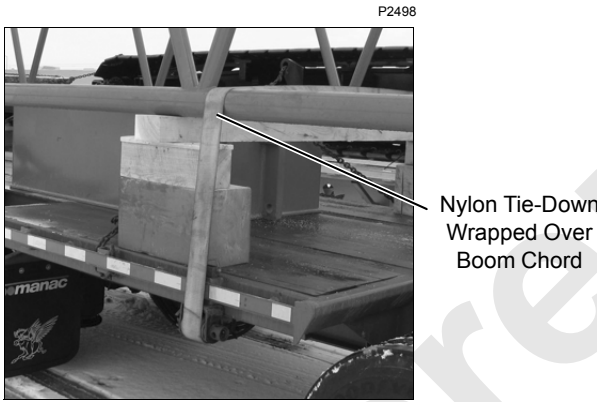
It is the owner/user's responsibility to ensure the following:

- All trailer loads comply with local, state, and federal transportation requirements.
- **All crane components are properly blocked and secured so they cannot shift or fall off trailers.**
- To avoid damage to components:

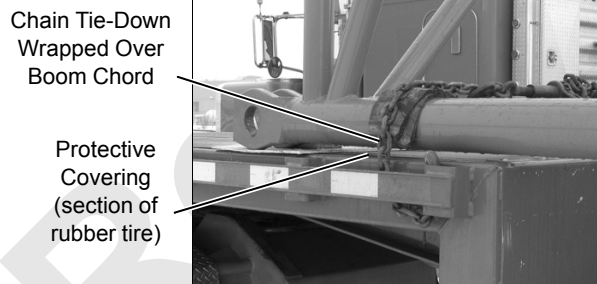
Nylon tie-downs secure components as shown in [Figure 4-3](#), View A.

If chain tie-downs are used, protective coverings (such as sections of rubber tire) are installed between the chain and component being secured as shown in [Figure 4-3](#), View B.

On secured boom sections, tie-downs are wrapped over the chords—never over the lacings. Keep tie-downs as close to blocking as possible (View A) to prevent bending the chords.



View A



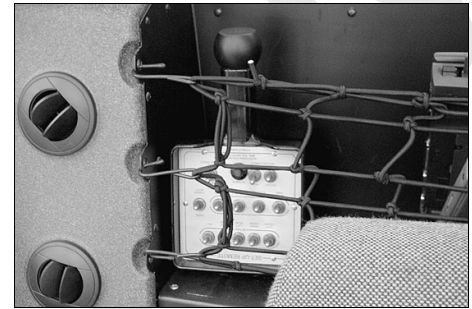
View B

FIGURE 4-3

## OPERATING CONTROLS

To use the live mast as a boom for self-erecting, the Liftcrane Mast Capacities Chart must be selected in the Rated Capacity Indicator/Limiter (RCL/RCI) Configuration screen. See RCL/RCI manual for instructions.

Switches on the hand-held radio remote control operate the boom hinge pins, upper counterweight cylinder pins, cab raise/lower cylinder, and mast assist cylinders ([Figure 4-4](#)). The remote control also selects engine speed.



Remote control stored in rear of operator cab

FIGURE 4-4

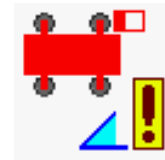
The remote control must be turned on in the Main Display. See the Remote Controls topic in Section 3 for remote control operating instructions.

The carbody jacks are controlled by four manual handles at the front of the carbody ([Figure 4-6](#)).

The swing and travel alarm will sound if the rotating bed is 3° out of level. Operation will not stop, but use caution.

Operation will stop and the CRANE OUT OF LEVEL WHEN JACKING icon will appear on the fault screen if the rotating bed is 4-1/2° out of level. The operator shall readjust the carbody jacks in the safe direction to continue operation.

CRANE OUT OF LEVEL WHEN JACKING



### WARNING Tipping Hazard!

Do not allow the carbody to go more than 4-1/2° out of level while jacking.

Jacks could buckle, allowing the carbody and rotating bed to tip over.

## PRE-START CHECKS

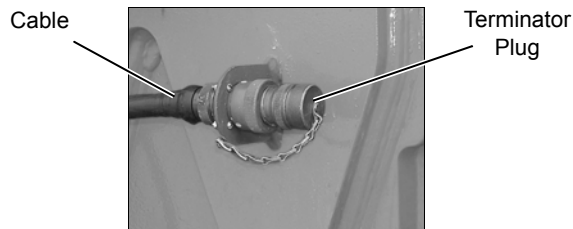
Complete the following checks before starting the engine upon arrival at the assembly site. See Section 3 for starting instructions.

### Engine

Perform the following engine checks:

1. Check for leaks.
2. Check the fuel, oil, and coolant levels.
3. Repair or refill as required.

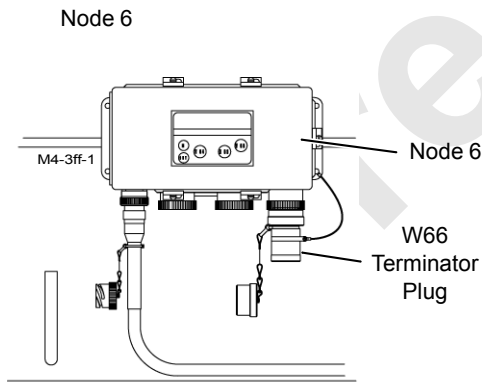
**NOTE:** The engine may not start (faults will occur) until terminator plugs are connected as shown in [Figure 4-5](#).



P2235

#### View A

On Right Outboard or  
Inboard Side of Rotating Bed



#### View B

On Front of Rotating Bed

FIGURE 4-5

### Gear Boxes

Perform the following gear box checks:

1. Check for leaks.
2. Check all fluid levels.
3. Repair or refill as required.

### Hydraulic System

Perform the following hydraulic system checks:

1. Check for leaks.
2. Check all fluid levels.
3. Repair or refill as required.
4. Make sure the hydraulic shut-off valve is open.

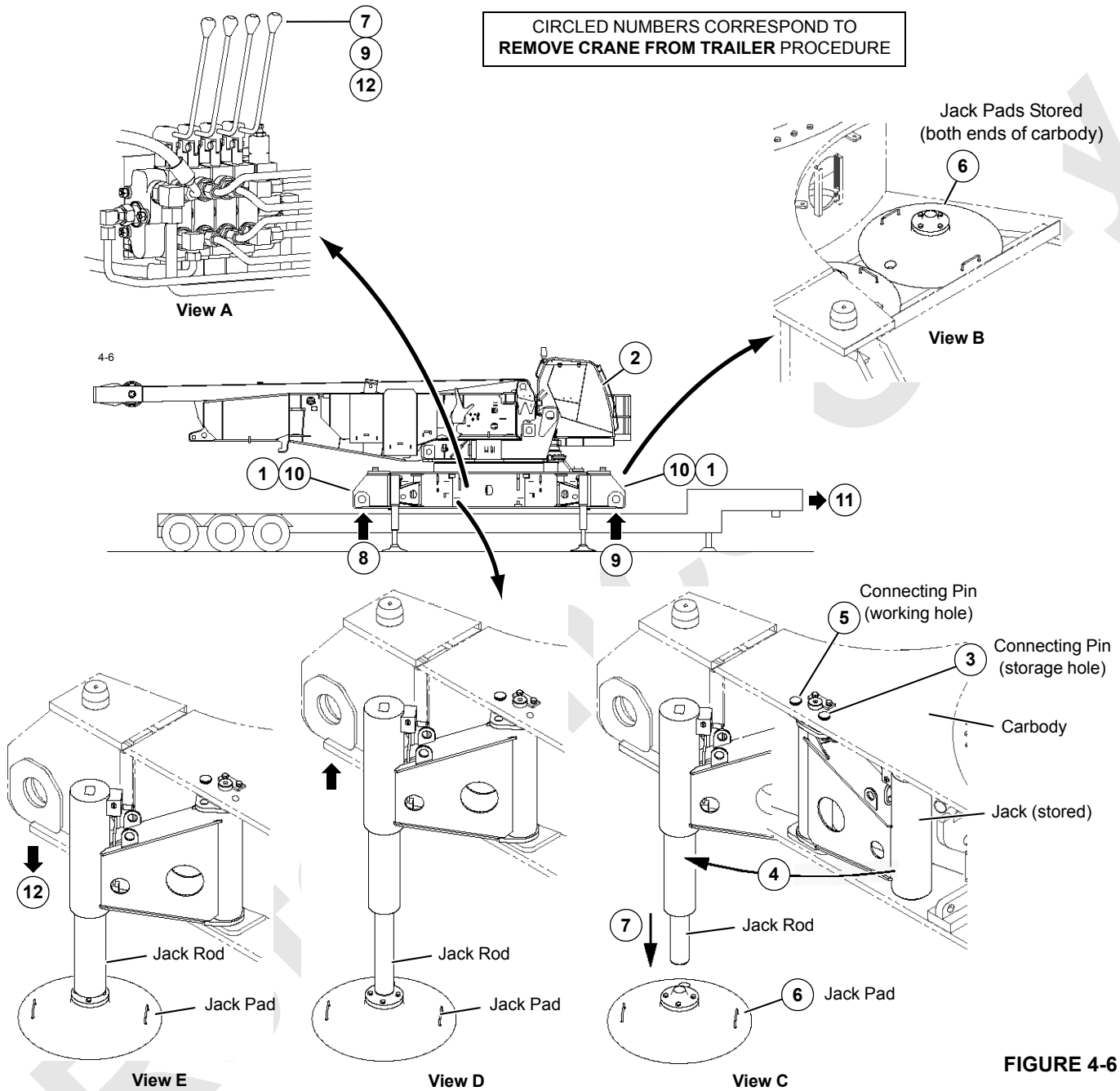


FIGURE 4-6

## CRANE ASSEMBLY

### Remove Crane from Trailer

 **WARNING**  
**Tipping Hazard!**

The small diameter of the jacking cylinders must be fully retracted before handling the first crawler, otherwise the cylinders will be overloaded.

See [Figure 4-6](#) for the following procedure:

1. Untie the crane from the trailer.
2. Perform the pre-start checks and start the engine.

**NOTE:** It is normal for the system fault alert and operating limit alert to come on when the engine is started.

The system fault alert should go off as the engine oil pressure and hydraulic oil temperature rise to normal. *If the alert does not go off soon after start-up, determine the fault, stop the engine, and correct the cause of fault* (see the Display Readings topic in Section 3).

3. Remove the connecting pin from the storage hole (View C).
4. Rotate the jack out from the storage position to the working position (View C).
5. Install the connecting pin in the working hole (View C).
6. Remove the jack pad from storage (View B) and place it on the ground below the jack rod (View C).

 **WARNING**  
**Moving Part Hazard!**

To avoid a serious crushing injury, warn all personnel to stand clear of the jacks.

**Tipping Hazard!**

Avoid tipping the crane over. Keep the crane level while jacking.

**NOTE:** A 2-way level is near the controls on the front of the carbody.

7. Extend the jack rod (View C) with the corresponding control on the carbody (View A) until the end of the jack rod engages the jack pad (View D).
8. Repeat steps [3](#) through [7](#) for each jack.
9. Using the controls on the front of the carbody, extend the carbody jacks fully to raise the crane off the trailer. **Swinging is prohibited.**
10. Remove all blocking from between the crane and the trailer.
11. Remove the trailer. **Take extreme care not to hit the jacks with the trailer. A signal person should give instructions to the truck driver.**
12. Retract the jacks—keep the crane level—until the carbody is approximately 635 to 559 mm (25 to 22 in) above the ground and the small diameter jack rod is fully retracted (View E).

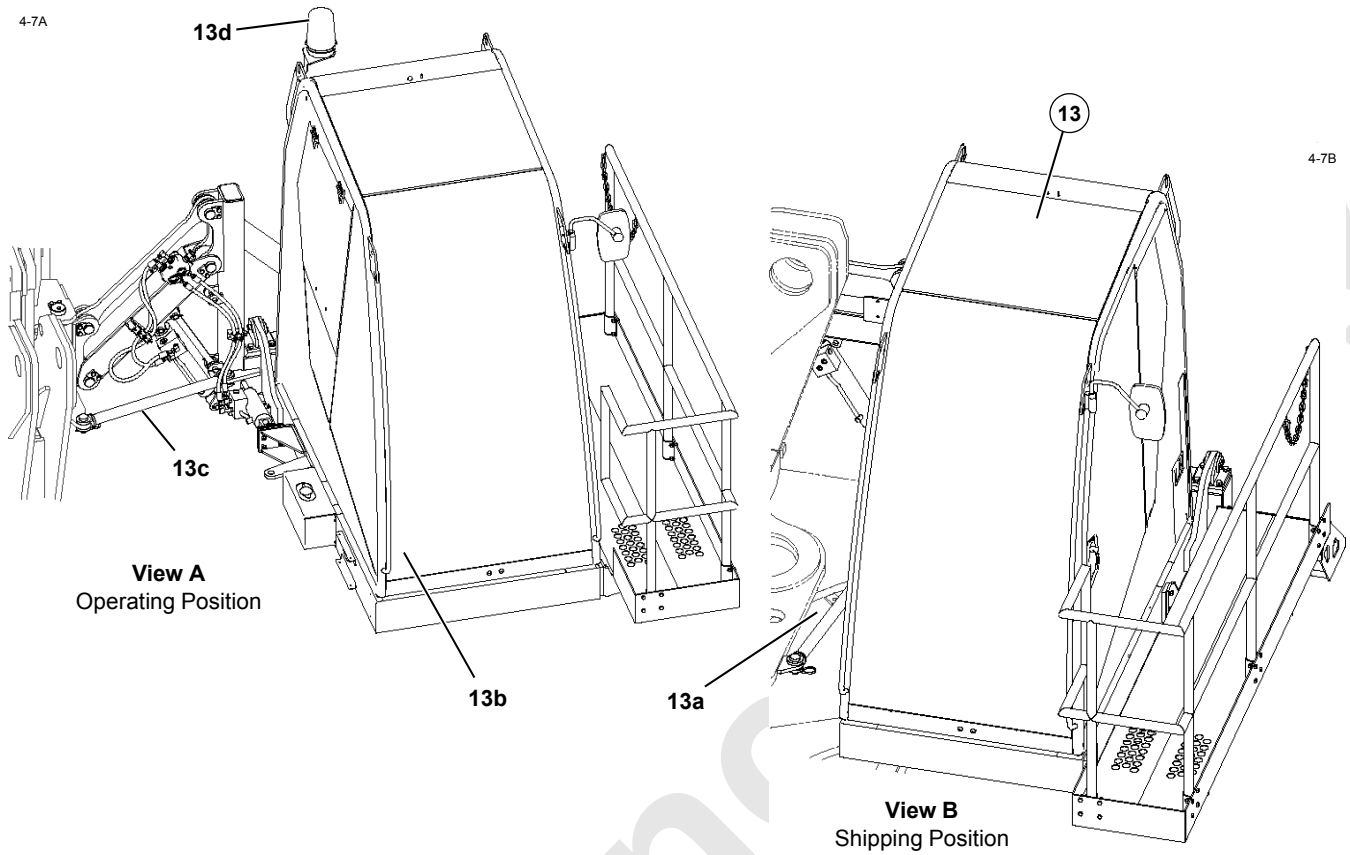


FIGURE 4-7



See [Figure 4-7](#) for the following procedure:

**13.** Rotate the operator cab to the operating position:

- a.** Unpin the cab strut from the lug on the adapter frame (View B).
- b.** Using the cab raise/lower switch on the remote control, raise the cab to the operating position (View A).
- c.** Rotate the operator cab 90° from the shipping position.
- d.** Pin the cab strut to the lug on the cab support (View A).
- e.** On top of the cab (View A), move the amber rotating beacon to the operating (vertical) position and secure it with the provided screws. Install the radio antenna.

Reference Only

Item	Description
1	Live Mast
2	Mast Assist Arm and Cylinder
3	Boom Hoist
4	Boom Hoist Wire Rope

4-8

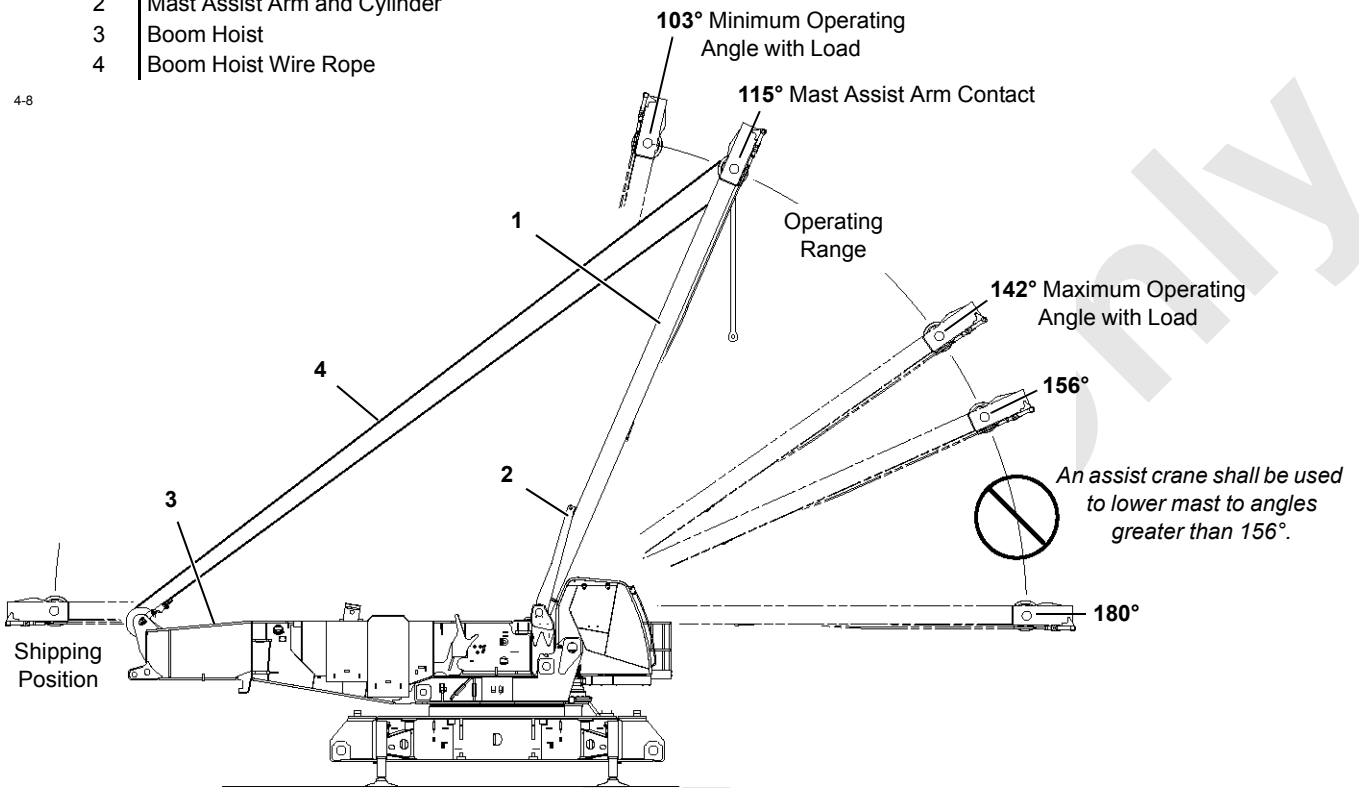


FIGURE 4-8

## Raise Live Mast to Operating Position

See [Figure 4-8](#) for the following procedure.

Use the following controls to raise the mast. See the Operating Controls topic in Section 3 for identification and operation of these controls.

Use the mast arms control to raise and lower the mast arms independently of the mast. Use the boom hoist control to raise and lower the mast while using the mast as a boom. Use the RCL display to select the Liftcrane Mast Capacities Chart. Use the Main Display information screen to monitor the mast operating angle and to identify mast faults.

To raise the live mast to the operating position, use the following:

1. Go to the RCL display and select the Liftcrane Mast Capacities Chart.

**NOTE:** The mast controls will not operate and the mast operating limits will remain off until the Liftcrane Mast Capacities Chart is selected.



### WARNING

#### Falling Mast Hazard!

Prevent the mast from falling over backwards or forward:

- Read and thoroughly understand the mast raising instructions.
- Select the Liftcrane Mast Capacities Chart in the RCL configuration screen before raising the mast and using it as a boom. Mast operating limits remain off until this step is performed.

### CAUTION

#### Mast Damage!

Make sure the mast angle indicator is properly installed and calibrated prior to raising the mast.

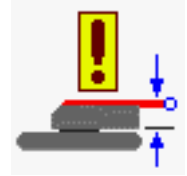
The mast can be damaged if the angle indicator is not properly installed.

2. Monitor the mast angle on the Main Display information screen during this procedure.
3. Increase engine speed to the desired RPM.
4. Using the mast switch on the remote control, raise the mast assist arms (2) until the cylinders stop.

The following will occur if this is not done before the next step:

- The mast will not rise
- The hazard warning buzzer will come on
- The hazard warning symbol and mast below 2 degrees icon will appear on the fault screen

MAST BELOW 2  
DEGREES  
FAULT ICON



5. Boom down with the boom hoist control to raise the live mast (1) to the operating position.

The mast will rise as the mast assist arm cylinders (2) extend automatically.

The mast assist arms will stop rising automatically when the mast assist cylinders are fully extended (approximately 115°).

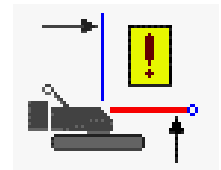
6. Proceed to use the mast as a boom with the boom hoist control for the remainder of the self-erect assembly procedure.

**See the Liftcrane Mast Capacities Chart at the end of this section for detailed lifting capacities.**

**NOTE:** The following will occur if the mast is lowered to 156°:

- The mast will stop lowering
- The hazard warning buzzer will come on
- The hazard warning symbol and mast too far forward icon will appear on the fault screen

MAST TOO FAR  
FORWARD ICON



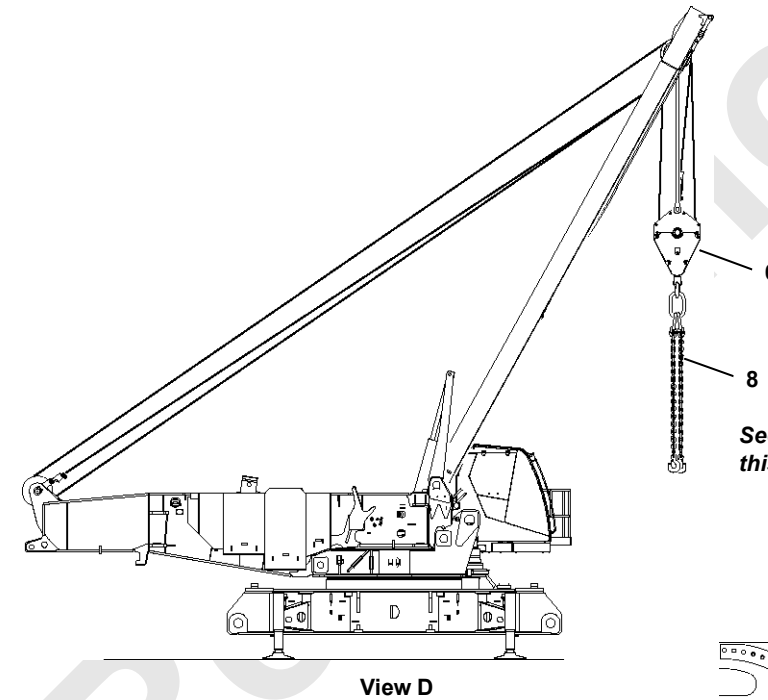
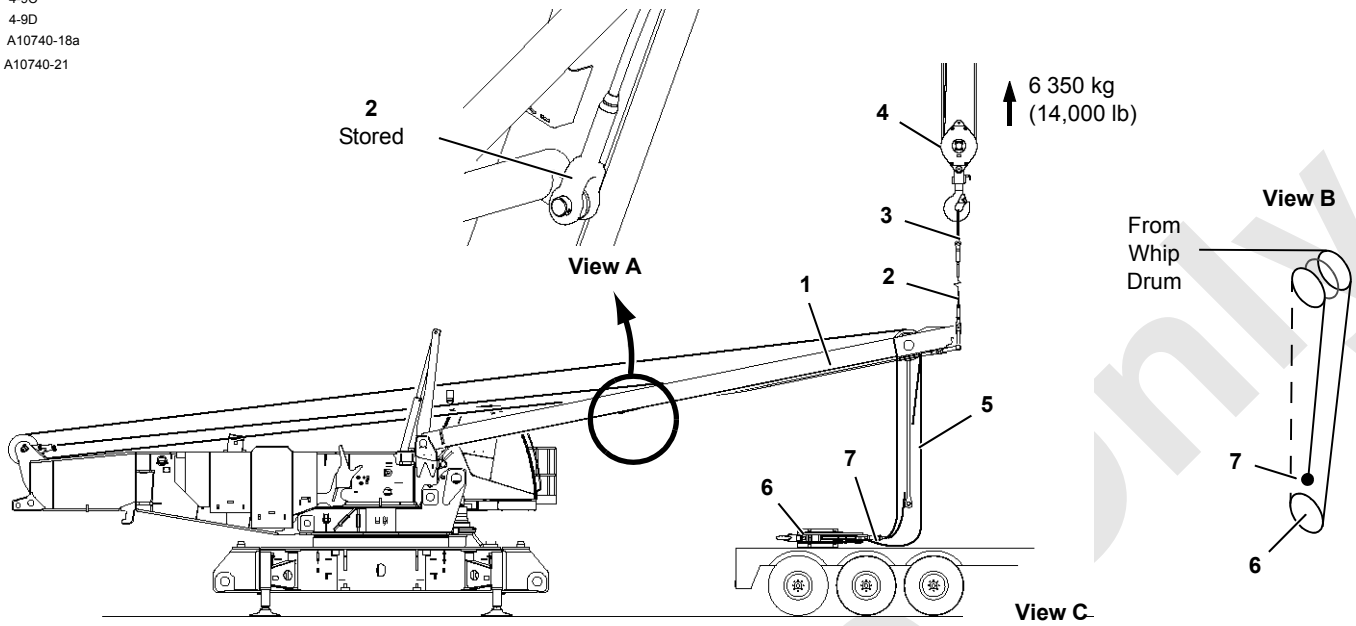
### WARNING

#### Falling Mast Hazard!

Prevent the mast from falling:

- Do not use the limit bypass to lower the mast below 156°. The mast will fall suddenly. **Connect an assist crane to the end of the live mast when it is necessary to lower it below 156°.**
- Do not lower the mast assist arms until the live mast is connected to the boom rigging. The mast will fall over backward if raised above 115° when the arms are down.

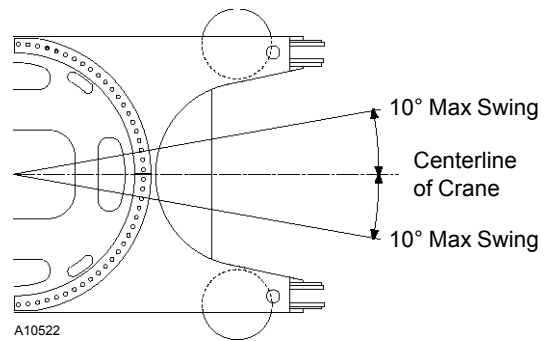
4-9C  
4-9D  
A10740-18a  
A10740-21



**Component Identification**

Item	Description
1	Live Mast
2	Handling Pendant
3	Owner-Furnished Nylon Slings
4	Assist Crane Load Block
5	Mast Straps
6	Load Block 41 t (45 UST)
7	Button Socket
8	4-Leg Chain Sling

See the *Liftcrane Mast Capacities Chart* at end of this section for detailed lifting capacities.



A10522

**View E**  
*While Handling First Crawler*

**FIGURE 4-9**

## Install Assembly Block

See [Figure 4-9](#) for the following procedure:



### WARNING

#### Falling Mast Hazard!

Prevent the mast from falling:

- Do not use the limit bypass to lower the mast below 156° until the **mast is supported with slings from the assist crane**.
- The assist crane must be able to lift 6 350 kg (14,000 lb).

1. Position the trailer carrying the assembly block (6) as shown in View C.
2. Boom down to lower the mast (1) to approximately 160°.
3. Unpin the handling pendants (2, View A) from the mast and attach the pendants to the assist crane block (4) with nylon lifting slings (3).
4. Support the mast using the assist crane.
5. Lower the mast to the desired position using the assist crane. **Do not side load the mast.**

Use the limit bypass switch to bypass the mast limit and pay out the boom hoist wire rope as the assist crane lowers the mast.



### WARNING

#### Crush Hazard!

Do not stand or work under the mast unless it is supported by the assist crane.

### CAUTION

#### Equipment Damage!

To prevent damage, guide the mast straps (5) clear of the trailer as required.

6. Reeve the wire rope from the whip drum through the sheaves in the mast point and assembly block (6, View B).

7. Anchor the wire rope to the button socket (7, View B) on the load block (see the Wire Rope Installation and Maintenance topic in this section).
8. Connect the 4-leg chain sling (8, View D) to the assembly block.
9. Raise the mast to at least 156° using the assist crane. As the mast is raising:
  - Pay out the load line from the whip drum
  - Haul in the wire rope on the boom hoist
10. Once the mast is at or above 156°, support the mast using the boom hoist wire rope and disconnect the handling pendants (2) from the assist crane block.
11. Pin the handling pendants to the mast for storage (View A).
12. Haul in the load line on the whip hoist to lift the assembly block off the trailer.
13. Position the mast in the operating range (see [Figure 4-8](#)).

## Install Crawlers

The crane must be in the following configuration to install the crawlers:

- Mast arms fully raised
- The Liftcrane Mast Capacities Chart selected on the RCL display configuration screen
- Swing limited to 10° on either side of center when handling first crawler ([Figure 4-9](#), View E)
- Mast operated within the limits of the Liftcrane Capacities Chart at the end of this section



### WARNING

#### Tipping Hazard!

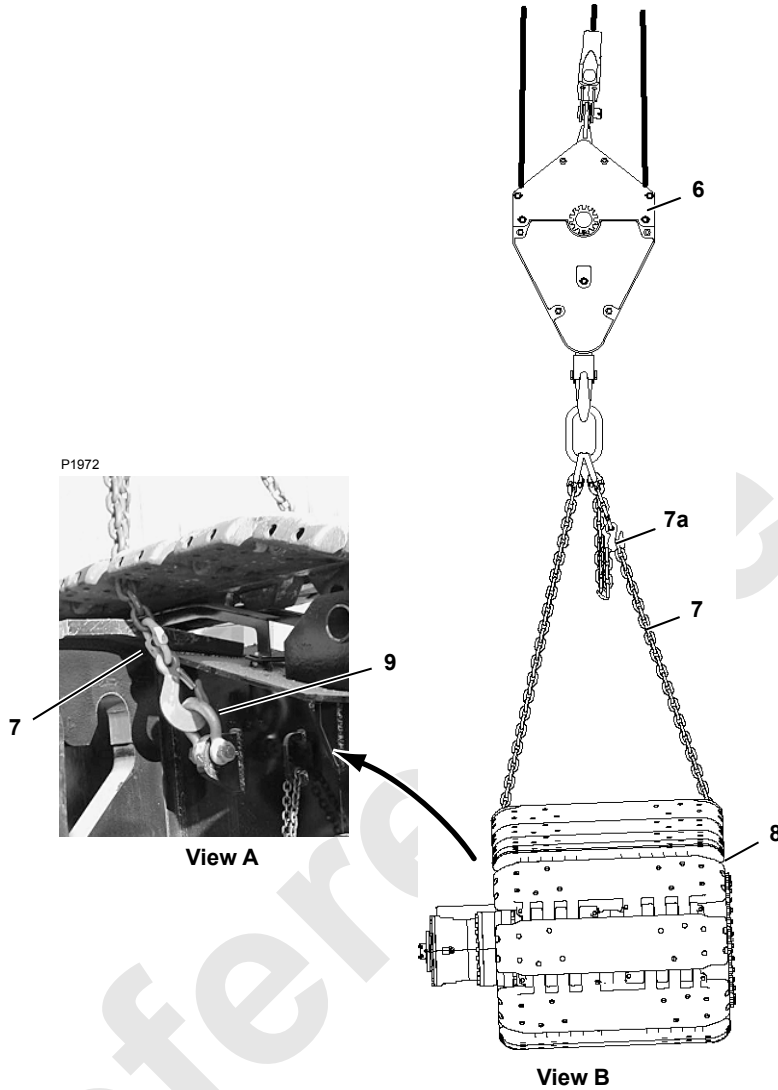
- Do not exceed the capacities given in the Liftcrane Mast Capacities Chart when handling the crawlers with the mast. The crane will tip forward.
- Make sure the crane is level. Adjust the jacks as required.

### CAUTION

#### Parts Damage!

Avoid hitting the carbody jacks with the crawlers.

A10740-11bb



**Component Identification**

Item	Description
6	Assembly Block
7	4-Leg Chain Sling
7a	Grab Hook
8	Crawler
9	Shackle

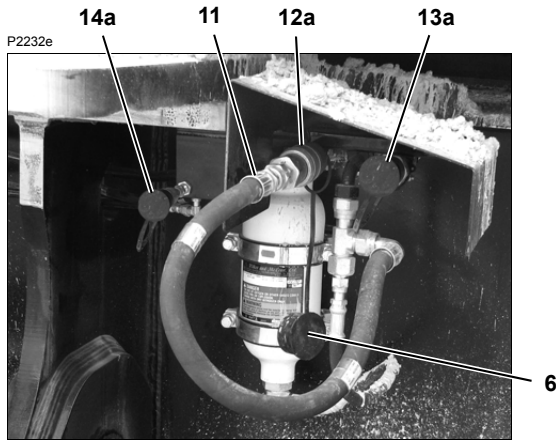
FIGURE 4-10

### Handling Crawlers

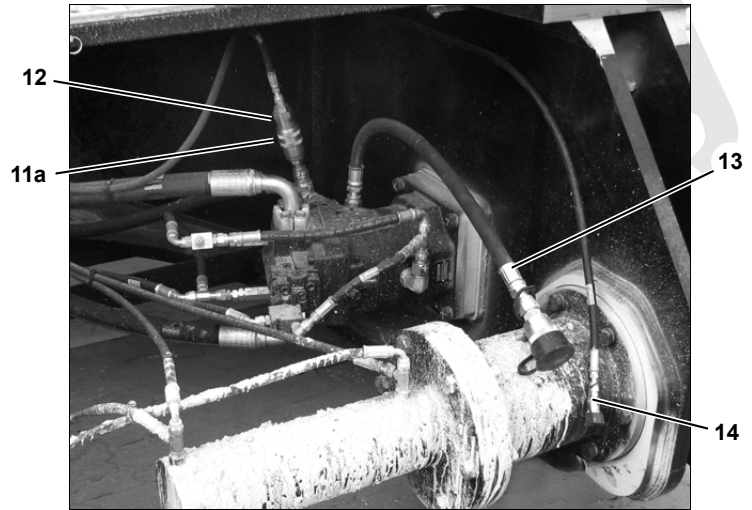
See [Figure 4-10](#) for the following procedure:

1. Attach the hooks from the chain sling (7, View A and B) to the four shackles (9) on the crawler lifting lugs, attaching the two legs with the grab hooks on the outboard side.

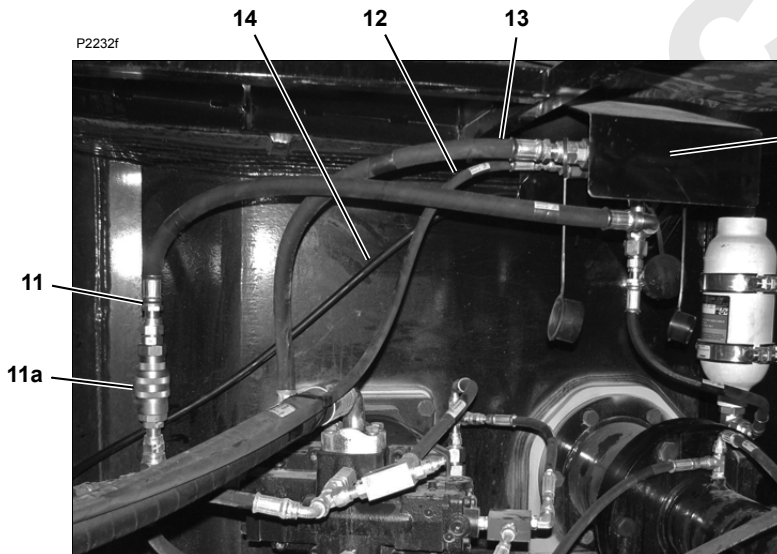
2. Using the grab hooks, shorten both outboard legs eleven chain links so the crawler tips inward when lifted.
3. Position the chains between the crawler pads (View A).



**View A**  
Crawler Shipping Arrangement



**View B**  
Carbody Shipping Arrangement



**View C**  
Carbody/Crawler Working Arrangement

12a and 13a  
Under Guard

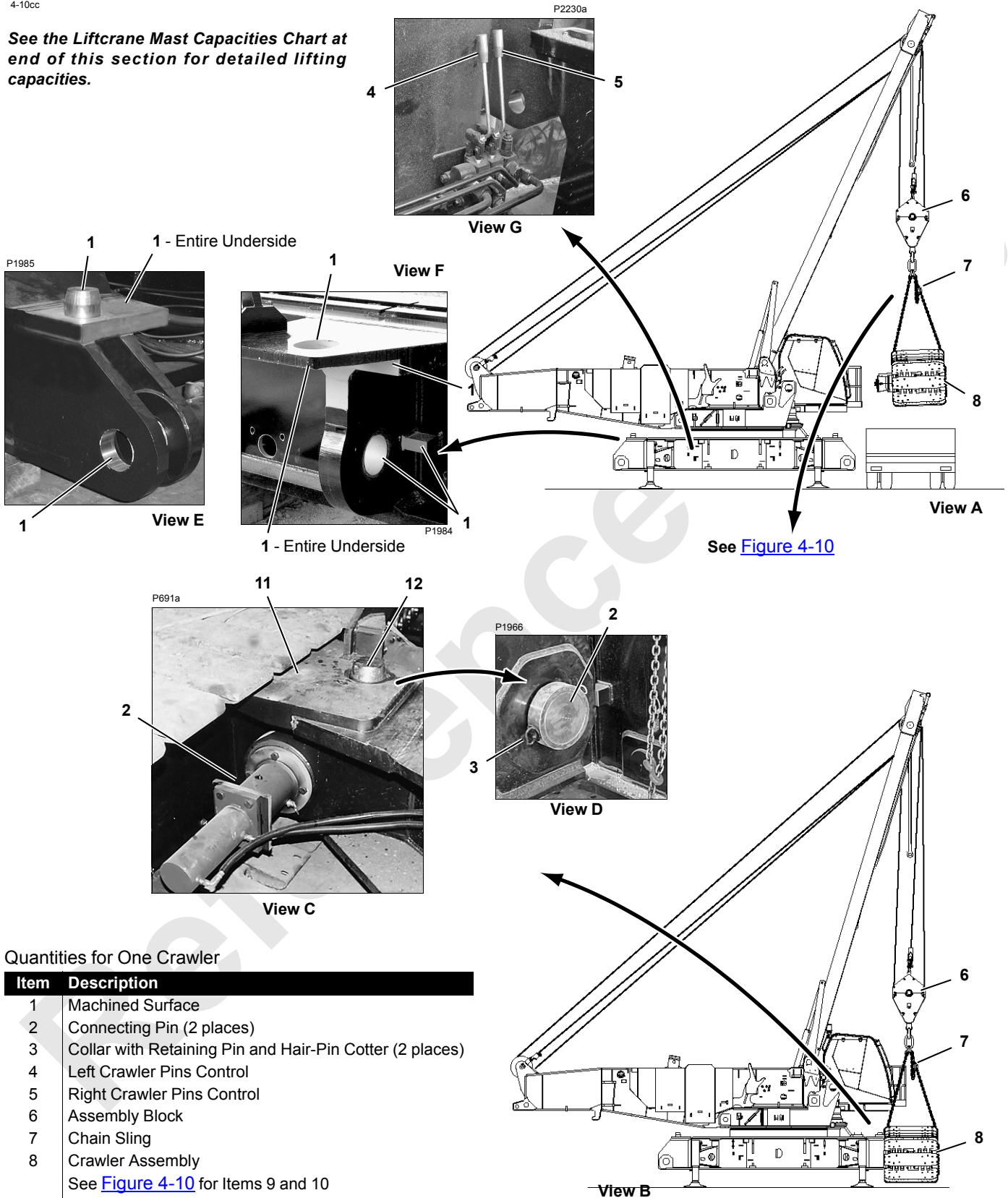
#### Component Identification

Item	Description
11	Hydraulic Hose
11a	Coupler
12	Hydraulic Hose
12a	Coupler
13	Hydraulic Hose
13a	Coupler
14	Grease Hose
14a	Coupler

**FIGURE 4-11**

4-10aa  
4-10cc

See the *Liftcrane Mast Capacities Chart* at end of this section for detailed lifting capacities.



Quantities for One Crawler

Item	Description
1	Machined Surface
2	Connecting Pin (2 places)
3	Collar with Retaining Pin and Hair-Pin Cotter (2 places)
4	Left Crawler Pins Control
5	Right Crawler Pins Control
6	Assembly Block
7	Chain Sling
8	Crawler Assembly
	See <a href="#">Figure 4-10</a> for Items 9 and 10
11	Crawler Lug (2 places)
12	Fixed Pin (2 places)

FIGURE 4-12



**Install First Crawler**

To prevent the crawler pads from sagging too much when the crawler is lifted, chains are installed between the crawler frames and pads (see [Figure 4-13](#), View F). Some sag is necessary to prevent interference between the carbody and crawler pads.

To install the first crawler, use the following:

1. Thoroughly clean and grease all machined surfaces (1, [Figure 4-12](#), Views E and F) on the carbody and crawler.

Failing to clean and grease machined surfaces may result in loud banging sounds when attempting to turn the crane while traveling. These sounds are not harmful, but they may disturb personnel.

Once the crawlers are installed, the drive shafts will be at opposite corners. The drive shaft on the left side of the crane will be at the rear. The drive shaft on the right side will be at the front.

2. Position the trailer carrying the crawler along the desired side of the crane (View A).
3. Disconnect the hydraulic hoses (see [Figure 4-11](#)):
  - Hose 11 (View A) from coupler 12a
  - Hose 12 (View B) from coupler 11a

Move the hoses out of the way so they do not interfere with crawler installation.

See [Figure 4-12](#) for the remaining steps:

4. Remove the collars (3, View D) and retract the crawler connecting pins (2) using the crawler pins control (4 or 5, View G).  
Grease the crawler pins while they are disengaged. See Section 5 for lubrication information.
5. Attach the hooks from the chain sling (7, View A) to the crawler as shown in [Figure 4-10](#).
6. Tilt the operator cab up as required so the crawler does not hit the cab.
7. Slowly hoist the crawler clear of the trailer.
8. Remove the trailer.
9. Slowly lower the crawler, mast up, and swing to engage the holes in the crawler lugs (11, View C) with the fixed pins (12) in the carbody.
10. Continue to lower the crawler until the handling chains go slack.
11. Using the control handle (4 or 5, View G), engage the crawler connecting pins (2, View D).
12. Install the collars (3, View D) and retaining pins.
13. Unhook the chain sling (7, View B) from the crawler.

**Legend for [Figure 4-13](#)**

Item	Description	Item	Description
1	Chain with Hook	8	Flange Screw (8 each)
2	Crawler Pad	9	Drive Shaft Guard
3	Crawler Lug	10	Safety Pin
4	Crawler Drive Shaft		See <a href="#">Figure 4-11</a> for Items 11 through 14
5	Storage Bracket	15	Crawler Assembly (First Installed)
6	Drive Shaft Flange (Carbody)	16	Carbody Jacks
7	Drive Shaft Flange (Crawler)	17	Crawler Assembly (Second Installed)

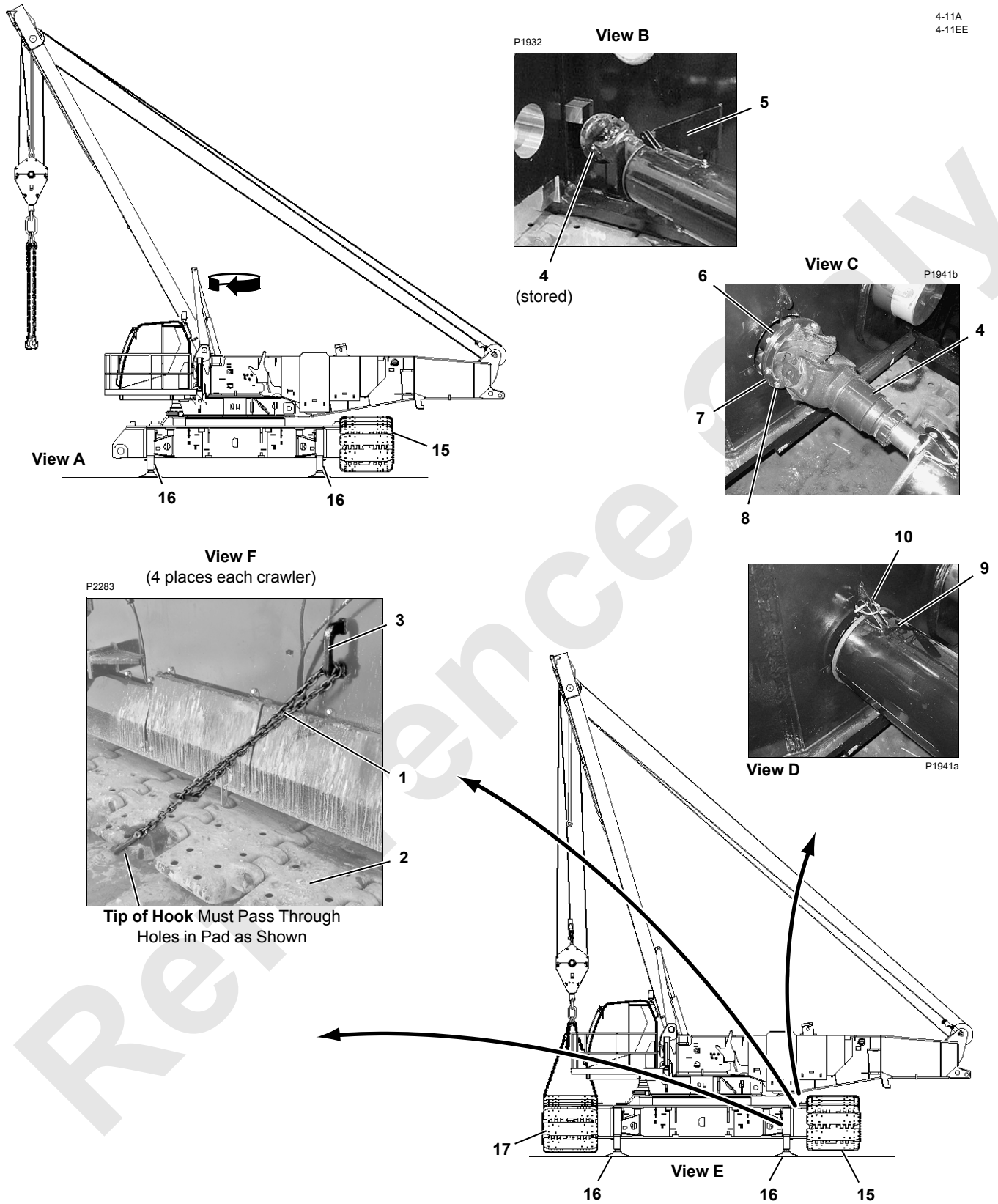


FIGURE 4-13

**Install First Crawler (continued)**

14. Swing 180° (View A) to the other side of the crane before handling the second crawler.

**WARNING****Rotating Drive Shaft Hazard!**

The crawler drive shaft rotates at high speed:

- Make sure the crawler drive shaft is securely attached at both ends.
  - Make sure the guards are in place and securely attached at both ends during operation.
  - Do not attempt to service the drive shaft until the crane is parked and the engine is stopped.
15. Lift the crawler drive shaft (4, View B) off the storage bracket (5), extend the shaft, and align the holes in the drive shaft flanges (6 and 7, View C).
16. Apply Never-Seez™ or an equivalent anti-seizing compound to the treads and under the flange screw heads (8, View C).
17. Insert the flange screws (8) and torque them to 102 N•m (75 ft-lb).
18. Slide the drive shaft guard (9) over the drive shaft and pin it to the carbody (View D).
19. Connect the hydraulic hoses (Figure 4-11, View C):
- Hose 11 to coupler 11a
  - Hose 12 to coupler 12a
  - Hose 13 to coupler 13a
20. Connect the grease line (14, Figure 4-11, View C) to coupler 14a (View A).

**Install Second Crawler**

See [Figure 4-13](#) for the following procedure:

**WARNING****Overload Hazard!**

Swing the crane 180° to the opposite side before handling the second crawler. The second crawler cannot be lifted over the same side as the first crawler without overloading the jacks.

**Tipping Hazard!**

Do not allow the assembly block to swing past the inside edges of the carbody jacks while installing the second crawler. The crane will tip.

Repeat the Install First Crawler steps 2 through 13 and 15 through 20 for the second crawler.

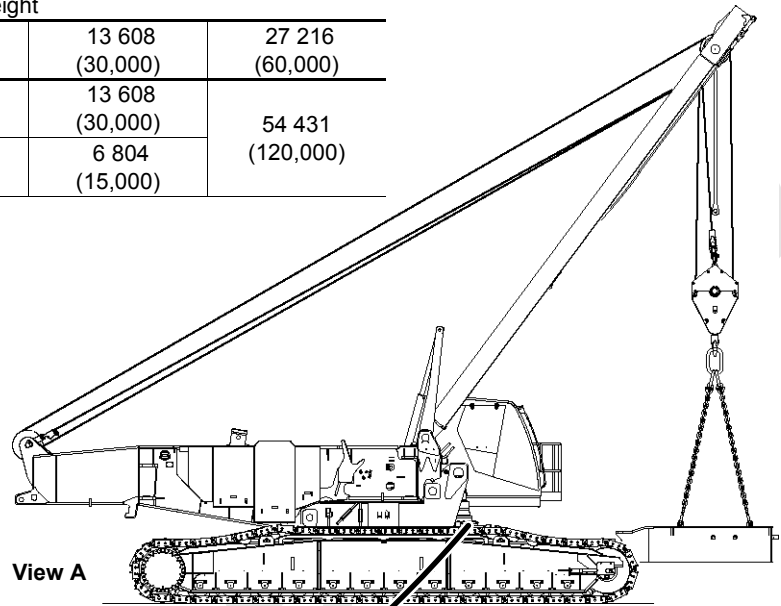
21. Lower the carbody until the crawlers are on the ground and fully retract the jacks.
22. Remove the chains (1, View F) from between the crawler pads (2) and crawler lugs (3) (four places each crawler). Store the chains for future use.
23. Remove and store the jack pads ([Figure 4-6](#), View C).
24. Position each carbody jack:
- a. Remove the connecting pin ([Figure 4-6](#), View B).
  - b. Swing the jacks in ([Figure 4-6](#), View A) and install the connecting pin.

4-13A  
A10786

**Carbody Counterweight Identification**

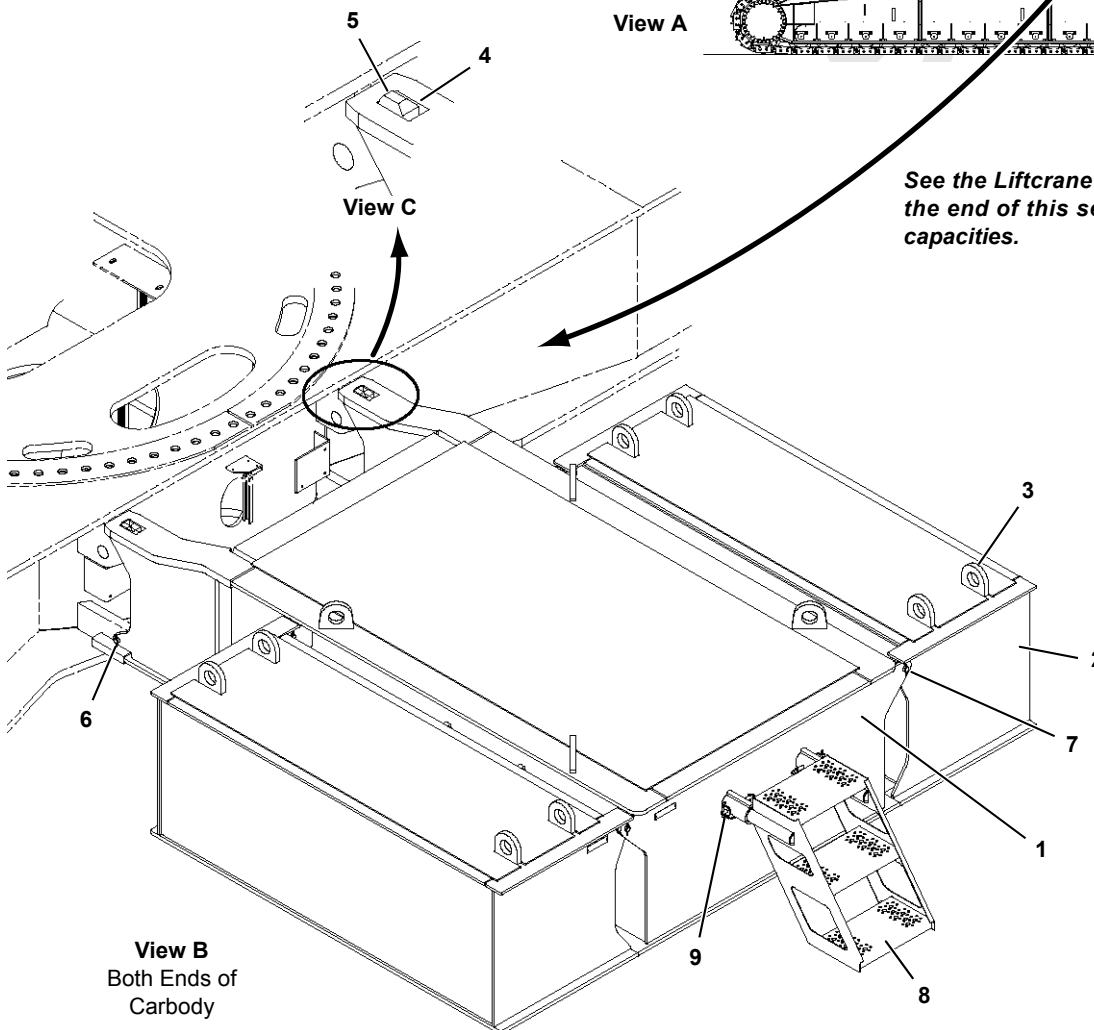
	Item	Description	Required Each End of Carbody	Weight Each kg (lbs)	Total Weight kg (lbs)
<b>Series 1</b>	No Carbody Counterweight				
<b>Series 2</b>	1	Center Box	1	13 608 (30,000)	27 216 (60,000)
<b>Series 3</b>	1	Center Box	1	13 608 (30,000)	54 431 (120,000)
	2	Side Box	2	6 804 (15,000)	

Item	Description
3	Lifting Lug (4 places each box)
4	Slot
5	Hook
6	Pin
7	Pin
8	Stairway (optional)
9	Pin (optional)



View A

See the Liftcrane Mast Capacities Chart at the end of this section for detailed lifting capacities.



View B  
Both Ends of  
Carbody

FIGURE 4-14

## Install Counterweight

See [Figure 4-14](#) for identification of the counterweight used on the 16000 Series 1, 2, or 3.

Identification and installation of additional counterweight for the 16000 Series 4 and 5 is in separate 16000 Wind Attachment manuals.



### WARNING

#### Tipping Hazard!

To prevent the crane from tipping, install the carbody counterweight before installing the crane counterweight.

### Install Carbody Counterweight

See [Figure 4-14](#) for the following procedure:

The carbody counterweight can be installed with the live mast. The crane must be in the following configuration to install the carbody counterweight:

- Mast assist arms fully raised. The mast will be at approximately 105° with the assist arms supporting the mast when attaching the carbody counterweights.
- Liftcrane Mast Capacities Chart selected on the RCL configuration screen.
- 360° swing permitted while handling the counterweight.
- Mast operated within the limits of the Liftcrane Mast Capacities Chart at the end of this section.

To install the carbody counterweight, use the following:

1. For **Series 2 and 3**, use the following:
  - a. Attach the crawler handling shackles to the lifting lugs (3) on the center box (1).
  - b. Attach the legs of the chain sling to the shackles.
  - c. Lift the center box into position at either end of the carbody.
  - d. Boom, hoist, and swing as required to engage the slots (4) in the top of the center box with the hooks (5) on the carbody as shown in View C.
  - e. Lower the center box until the bottom connecting holes line up.
  - f. Install the pins (6, View B).
  - g. Disconnect the chain sling and remove the shackles.
2. For **Series 3 only**, Install each side box:
  - a. Attach the crawler handling shackles to the lifting lugs (3) on the side box (2).
  - b. Attach the legs of the chain sling to the shackles.
  - c. Lift the side box (2) into position and pin it to the center box.
  - d. Disconnect the chain sling and remove the shackles.
  - e. Repeat steps a to d for the other side box.
3. Repeat step 1 or 2 at the other end of the carbody.
4. Attach the shackles to the crawlers for storage.

A11446-1

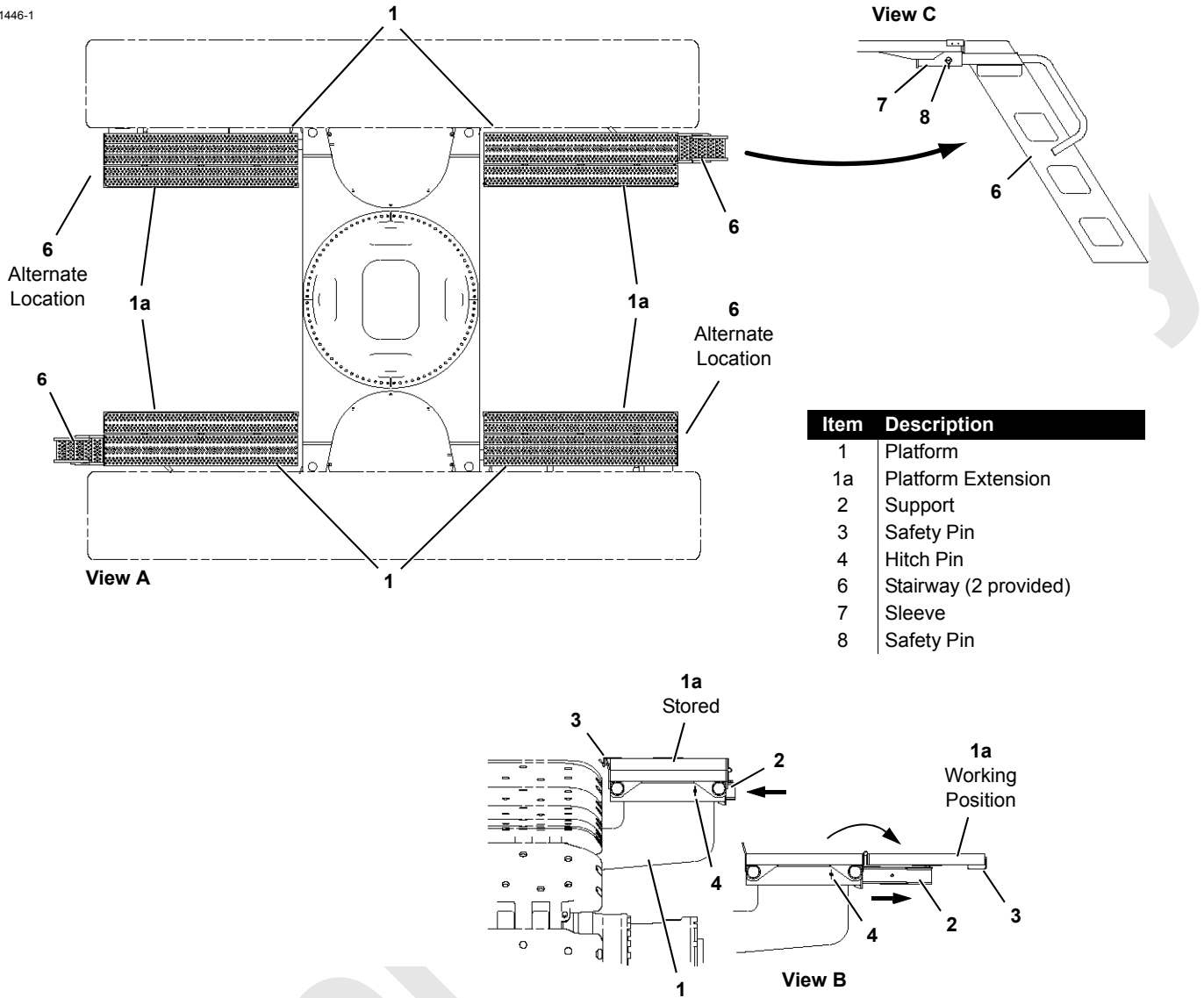


FIGURE 4-15

### **Install Crawler Platforms**

See [Figure 4-15](#) for the following procedure.

The crawlers are equipped with platforms (1) as shown in View A.

Once the crawlers are installed, rotate the platform extensions (1a) to the working position:

1. Remove the hitch pins (4) and pull the supports (2) out to the working position.
2. Install the hitch pins (4).
3. Remove the safety pins (3) and rotate the platform extensions (1a) to the working position.
4. Install the safety pins (3) in the ends of the platform extensions (1a).

### **Install Crawler Stairways**

See [Figure 4-15](#) for the following procedure.

If the crawler stairways are not already installed, use the following:

1. Using the nylon slings from the assembly block on the live mast, lift the stairway (6, View C) into position at the desired corner of the crawler platform (1).
2. Slide the tubes at the top of the stairway through the sleeves (7) on the underside of the platform.
3. Install the quick-release pins (8) to lock the stairway in place.
4. Repeat steps 1 through 3 for the stairway at the opposite corner.

**NOTE:** Stairways can be positioned at either end of either crawler to provide access that meets user needs.

A10787-2

Item	Description
3	Handling Pendant
4	Hydraulic Couplers
5	Hooks
6	Counterweight Pin
7	Hitch Pin
8	Adapter Plate
9	Lifting Sling (Owner Furnished)

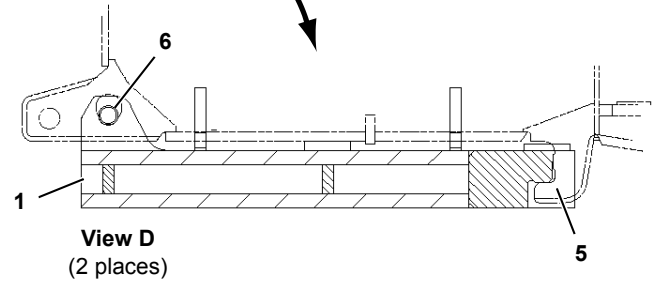
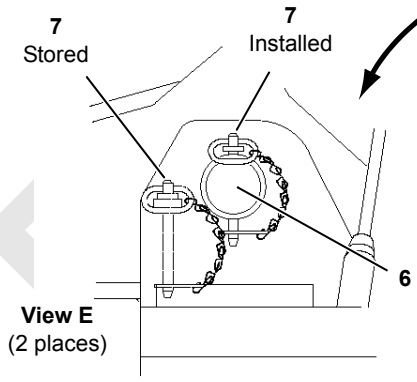
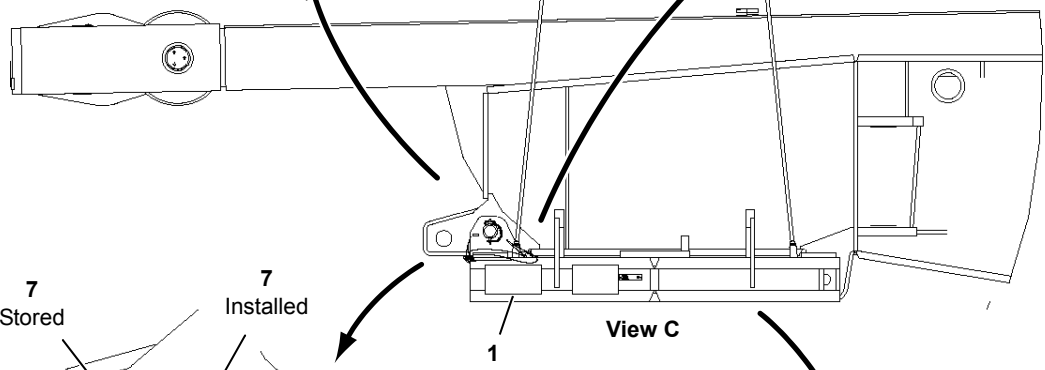
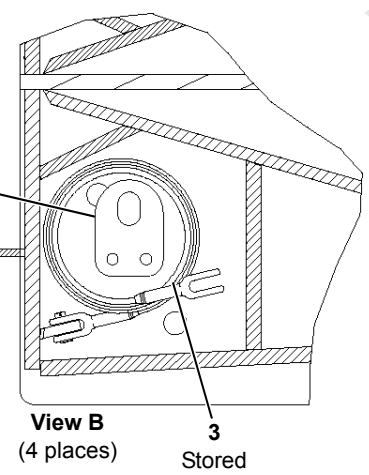
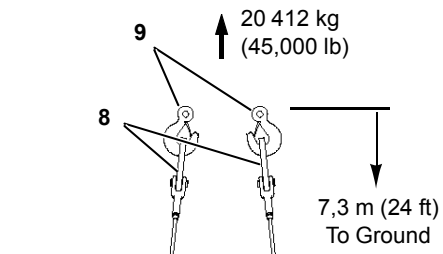
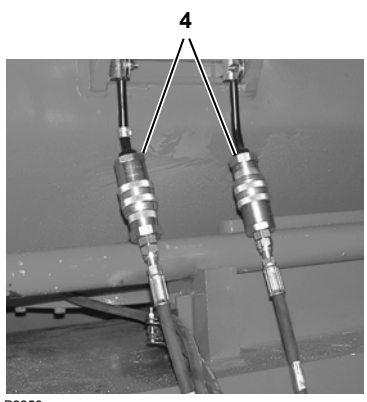


FIGURE 4-16



**Install Crane Counterweight**

An assist crane must install the crane counterweight.

The mast can be fully lowered as shown in [Figure 4-14](#) or forward of center as shown in [Figure 4-16](#).

See [Figure 4-16](#) for the following procedure:

1. Uncoil the handling pendants (3, View B) and adapter plates (8, View B) from the storage pockets in the tray (1) and hook them to the assist crane lifting slings (View C).

**! WARNING**  
**Falling Load Hazard!**

Pendants are designed to handle the counterweight tray only.

Do not attempt to lift the tray with the counterweight boxes installed. The pendants could break, allowing the counterweight tray and boxes to fall.

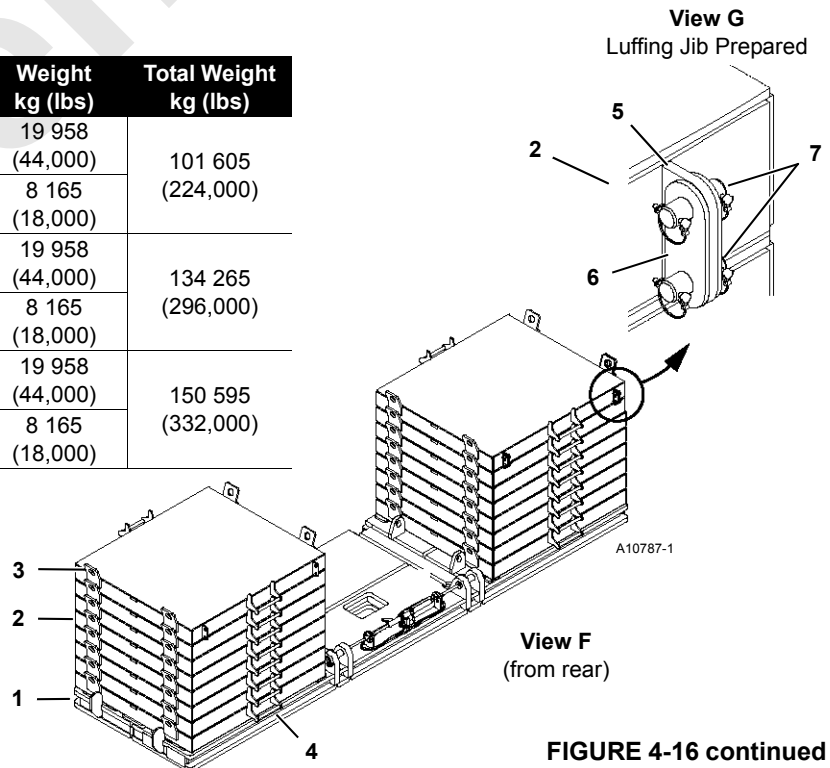
2. Lift the counterweight tray into position at the rear of the crane and place the tray on the ground.
3. Connect the hydraulic hoses from the counterweight cylinders to the couplers (4, View A) on the rear of the rotating bed.
4. Disengage the counterweight pins (6) using the switch on the remote control. Pins will engage if the switch is released.

5. Hoist, travel, boom, and swing as required using the assist crane to guide the counterweight tray into position under the rear of the rotating bed (View C).
6. Engage the hooks (5, View D) in the tray with the hooks in the rotating bed and align the connecting holes.
7. Release the switch on the remote control to engage the counterweight pins (6, View D).
8. Lower the counterweight until it is supported by the pins (The pendants will go slack).
9. Remove the hitch pins (7, View E) from the storage lugs and install them in the counterweight pins (6).
10. Unhook the handling pendants and adapter plates from the lifting slings. Coil the pendants and place the adapter plates in the storage pockets (View B).
11. Coil the hydraulic hoses on the tray for storage.
12. Do not disconnect the hydraulic hoses from the couplers on the rotating bed. Due to thermal expansion, they could be difficult to reconnect.
13. Stack the required counterweight side boxes (2, View F) one box at a time alternating from side to side:
  - Center the first box on each side of tray
  - Center the lifting lugs and steps on each box to the adjacent box
  - If the crane is luffing jib prepared, the side box (2) with lugs (5) must be installed on top of each stack

**Crane Counterweight Identification**

	Item	Description	Total Required	Weight kg (lbs)	Total Weight kg (lbs)
<b>Series 1</b>	1	Tray	1	19 958 (44,000)	101 605 (224,000)
	2	Side Box	10	8 165 (18,000)	
<b>Series 2</b>	1	Tray	1	19 958 (44,000)	134 265 (296,000)
	2	Side Box	14	8 165 (18,000)	
<b>Series 3</b>	1	Tray	1	19 958 (44,000)	150 595 (332,000)
	2	Side Box	16	8 165 (18,000)	

Item	Description
3	Lifting Lug (4 each box)
4	Step (2 each box)
5	Lug (4 each top box)
6	Link (8, one top box)
7	Pin (4, one top box)



**FIGURE 4-16 continued**

A10787-1

4-15D  
A10882  
M4-11c

Item	Description
1	Boom Butt
2	Wire Rope Guide
3	Lifting Lug
4	Pin with Cotter Pins
5a	Hoses
5b	Couplers in Boom Butt
5c	Couplers on Rotating Bed
6	Hinge Pin
7	Locking Pin
8	Shims

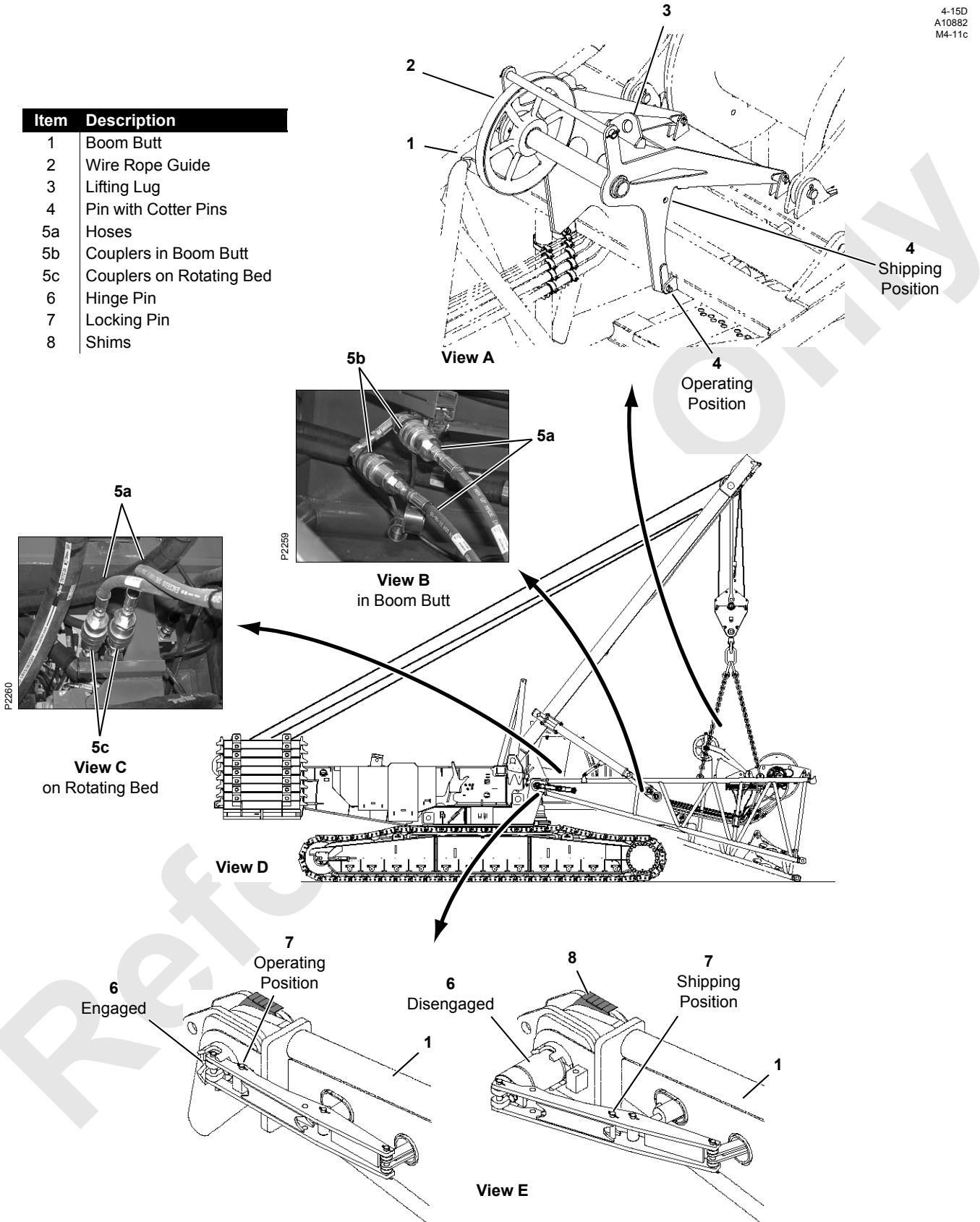


FIGURE 4-17

## Assemble Boom

The live mast can now be used to assemble the boom.

See the Boom Assembly topic later in this section for detailed instructions.

If a luffing jib will be installed, see the separate instructions in the Luffing Jib Operator Manual.

## Install Boom Butt

See [Figure 4-17](#) for the following procedure:

1. Raise the wire rope guide to operating position (View A):
  - a. Attach the lifting sling from the live mast to the lifting lug (3, View A) on the wire rope guide (2).
  - b. Support the wire rope guide so the pins (4) are loose and remove the pins.
  - c. Raise the wire rope guide from the shipping position to the operating position.
  - d. Install the pins (4).
  - e. Disconnect the lifting sling.

2. Attach the lifting slings from the live mast to the lifting lugs in the top chords of the boom butt (View D).

**Adjust the length of slings so the butt is horizontal when lifted.**

3. Lift the butt into position at the connecting holes in front of the rotating bed (View D).
4. Disconnect the hydraulic hoses (5a, View B) from the couplers (5b) in the boom butt.

**Thoroughly clean couplers to prevent dirt from entering the hydraulic system.**

5. Connect the hydraulic hoses (5a, View C) to the couplers (5c) on the left side of the rotating bed.
6. Using the setup remote control, disengage the boom hinge pins (6, View F).
7. Position the butt so the connecting holes in the butt line up with the connecting holes in the rotating bed.
8. Center the butt between the rotating bed lugs and check side play. If the total side play is greater than 2 mm (5/64 in), install shims (8, View E):
  - a. Install the thickest shim possible between the inboard side of the butt and rotating bed lug on both sides of crane.

**Shim tabs must face inward and rest on the rotating bed lugs.**

- b. Install the next thickest shim possible between the inboard side of the butt and first shim on both sides of the crane.
  - c. If possible, install the thinnest shim between the inboard side of the butt and the second shim on both sides of the crane.
9. Using the setup remote control, engage the boom hinge pins.
  10. Remove the locking pins (7, View E) from the shipping position and install them in the working position.
  11. Lower the butt onto the ground.
  12. Disconnect the slings.
  13. Disconnect the hydraulic hoses (5a, View C) from the couplers (5c) on the rotating bed and connect them to the couplers (5b, View B) in the butt.

### CAUTION

#### Boom Hinge Pin Damage!

Step [13](#) must be performed to relieve trapped pressure in boom hinge pin cylinders. Otherwise, damage to parts can occur.

14. Hold the retaining bar (2, [Figure 4-18](#), View D) down and remove the safety pin (3) from one end of the bar.
15. Slowly raise the retaining bar (2) and rotate the hydraulic hoses forward.
16. Repin the retaining bar for storage.
17. Remove the dust covers from the couplers on the boom butt and hydraulic hoses on the rotating bed.

**Thoroughly clean couplers to prevent dirt from entering the hydraulic system.**

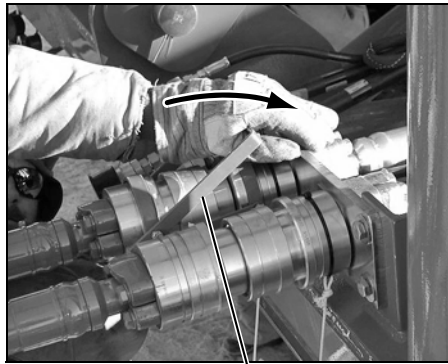
18. Connect the hydraulic hoses and couplers on the rotating bed to the couplers on the boom butt as shown in [Figure 4-18](#).

**NOTE:** These are straight line connections. No hoses will cross when the hoses are correctly connected.

The hoses and couplers between the boom butt and rotating bed have numbered tags. To ensure proper connection, match the numbers on the tags.

The coupler-assist tool ([Figure 4-18](#), View A) can be used to connect the large couplers.

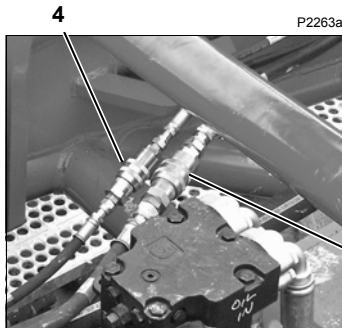
P2021



View A

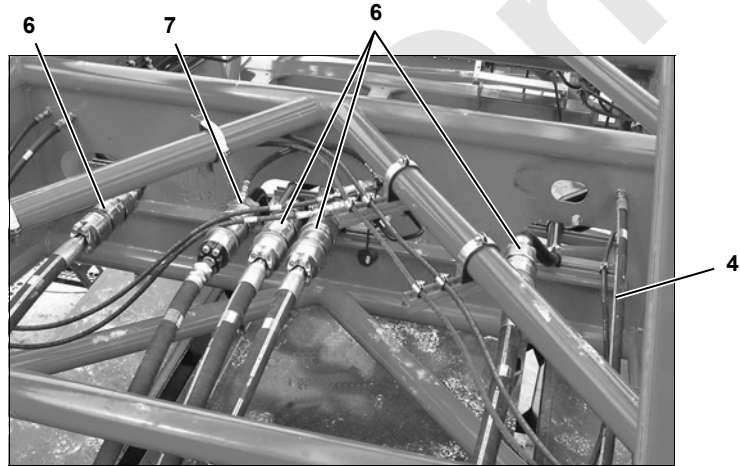
Item	Description
1	Coupling Assist Tool
2	Retaining Bar
3	Safety Pin
4	Motor Pilot
5	Anti-Cavitation
6	High Pressure
7	Case Drain

Views B and C are from Crane Looking Forward



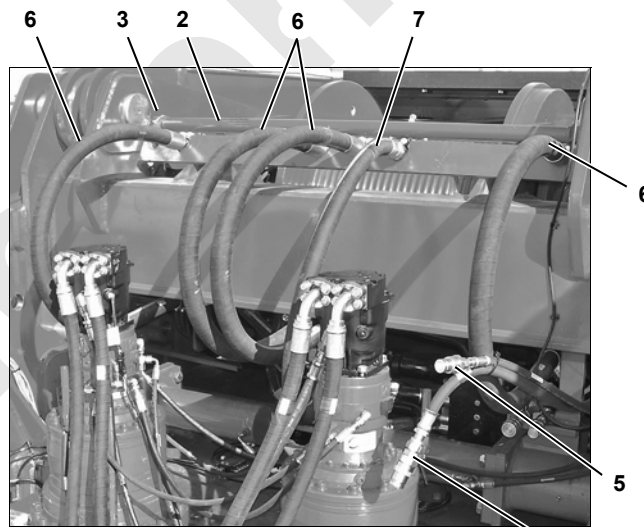
View B

P2263a



View C

P2264a



View D  
From Front

P2262a

FIGURE 4-18

Reference Only

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4-17B  
4-17C  
4-17F

Item	Description
1	Trailer
2	Boom Butt
3	Mast
4	Chain Sling
5	Assembly Block
6	Handling Pendant
7	Assist Crane Load Block
8	Nylon Sling
9	Mast Strap
10	Hooked Connector
11	Fixed Pin
12	Pin with Safety Pin

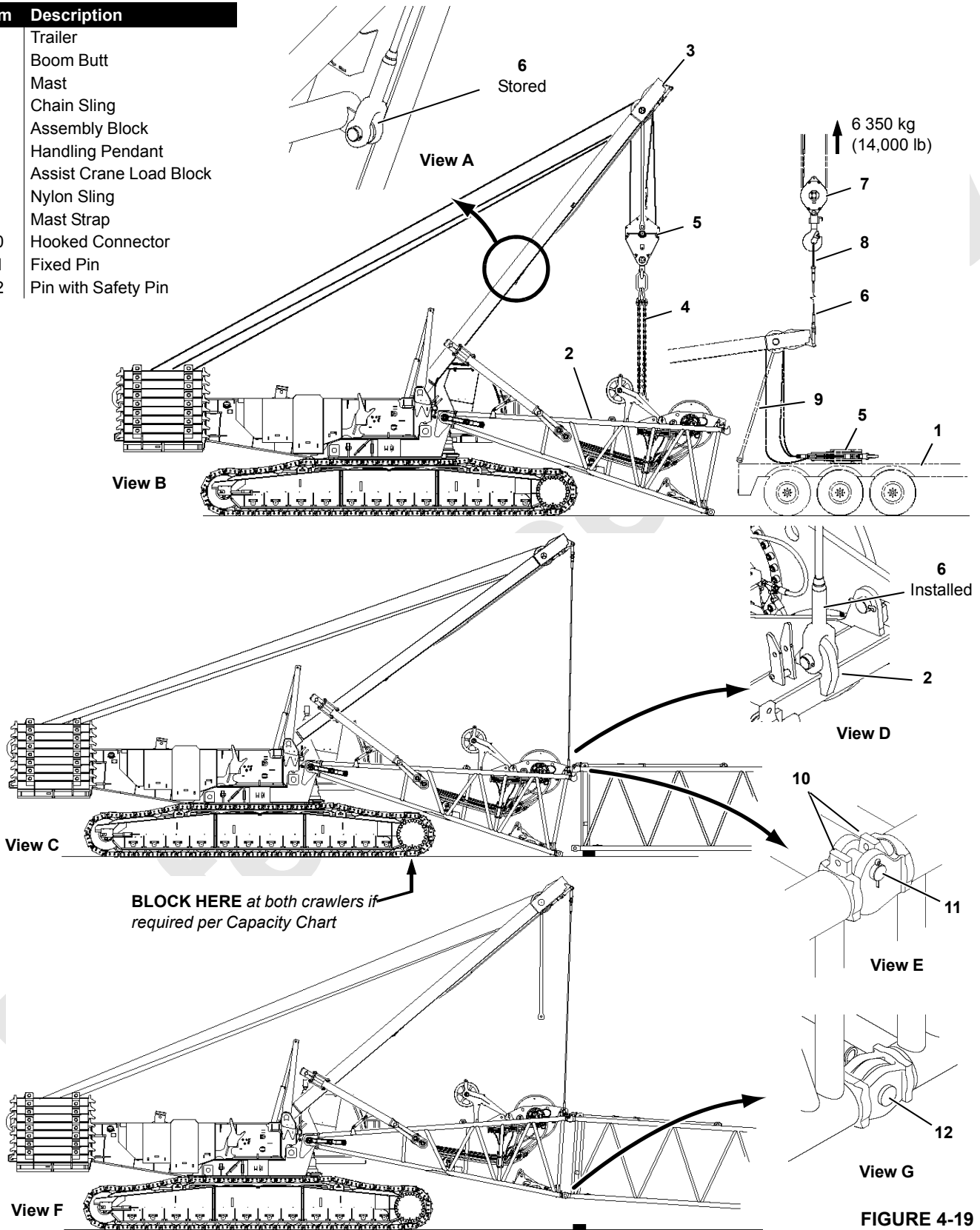


FIGURE 4-19

## Remove Assembly Block

See [Figure 4-19](#) for the following procedure:



### WARNING

#### Falling Mast Hazard!

Prevent the mast from falling:

- Do not use the limit bypass to lower the mast below 156° until the **mast is supported with slings from the assist crane**.
- The assist crane must be able to lift 6 350 kg (14,000 lb).

1. Position the trailer (1, View B) or other means of transport in front of the boom butt (2) as shown. Or, lower the assembly block onto the ground and remove it using the assist crane.
2. Boom down to lower the mast (3) to approximately 150°.
3. Guide the slings (4) and assembly block (5) around the end of the boom butt as the mast is lowered.
4. Unpin the handling pendants (6, View A) from the mast and attach the pendants to the assist crane block (7) using the nylon lifting slings (8).
5. Support the mast using the assist crane.
6. Lower the mast to the desired position using the assist crane. **Do not side load the mast.**

Use the limit bypass switch to bypass the mast limit and pay out the boom hoist wire rope as the assist crane lowers the mast.



### WARNING

#### Crush Hazard!

Do not stand or work under the mast unless it is supported by the assist crane.

7. Lower the assembly block (5, View B) onto the trailer or ground. Guide the mast straps clear of the trailer as required.
8. Remove the wire rope from the assembly block and mast and store it on the whip drum.

### CAUTION

#### Lacing Damage!

Take the necessary precautions while storing wire rope on a drum so the button end of the rope does not fall and damage the lacings in boom butt.

9. Raise the mast to at least 150° using the assist crane. As the mast is raised, haul in the wire rope on the boom hoist.
10. Once the mast is at or above 150°, support the mast with the boom hoist wire rope and disconnect the handling pendants (6) from the assist crane block.
11. Position the mast at approximately 140° (View C).

## Connect Boom Butt to Boom

See [Figure 4-19](#) for the following procedure:

1. Pin the handling pendants (6, View D) to the lugs on the boom butt (2).
2. Boom up to lift the boom butt clear of the ground.
3. Position the crane so the boom butt is in line with the end of the boom (View C).
4. Travel forward and boom down to align the hooked connectors (10, View E) in the boom butt with the fixed pins (11) in the adjacent insert.
5. See the Capacity Chart to determine if the crawlers must be blocked to raise the assembled length of boom. **If blocking is required, use the following:**
  - a. Mark the ground at the front end of the crawler—the center of the tumbler on one crawler, and the center of the front roller on the other crawler.
  - b. Disengage the boom butt from the insert and travel backward approximately 1,2 m (4 ft).
  - c. Install the required blocking at the points marked in step [a](#).
  - d. Repeat step 4.



### WARNING

#### Falling Boom Hazard

Do not attempt to lift the assembled boom with the handling pendants. The handling pendants could break, allowing the boom to fall.

6. Boom up slowly (View F) until the bottom connectors are lined up between the butt and insert.
7. Install the pins (12, View G).
8. Unpin the handling pendants (6, View D) from the boom butt and pin them to the mast (View A) for storage.

A10740-20a

Item	Description
1a	Mast Strap
1b	Insert Strap
2	Links
3	Pin (shipping)
4	Link (shipping)
5	Pin, with Collar, Retaining Pin, and Cotter Pins
6	Terminator Plug with Sealing Cap
7	Electric Cable on Crane
8	Electric Cable From Boom
9	Electric Cable from Drum 1 on Boom
10	Electric Cable from Drum 3 on Boom

**ARMS DOWN** before raising mast with boom connected to mast straps.  
**ARMS UP** before raising mast with boom disconnected from mast straps.

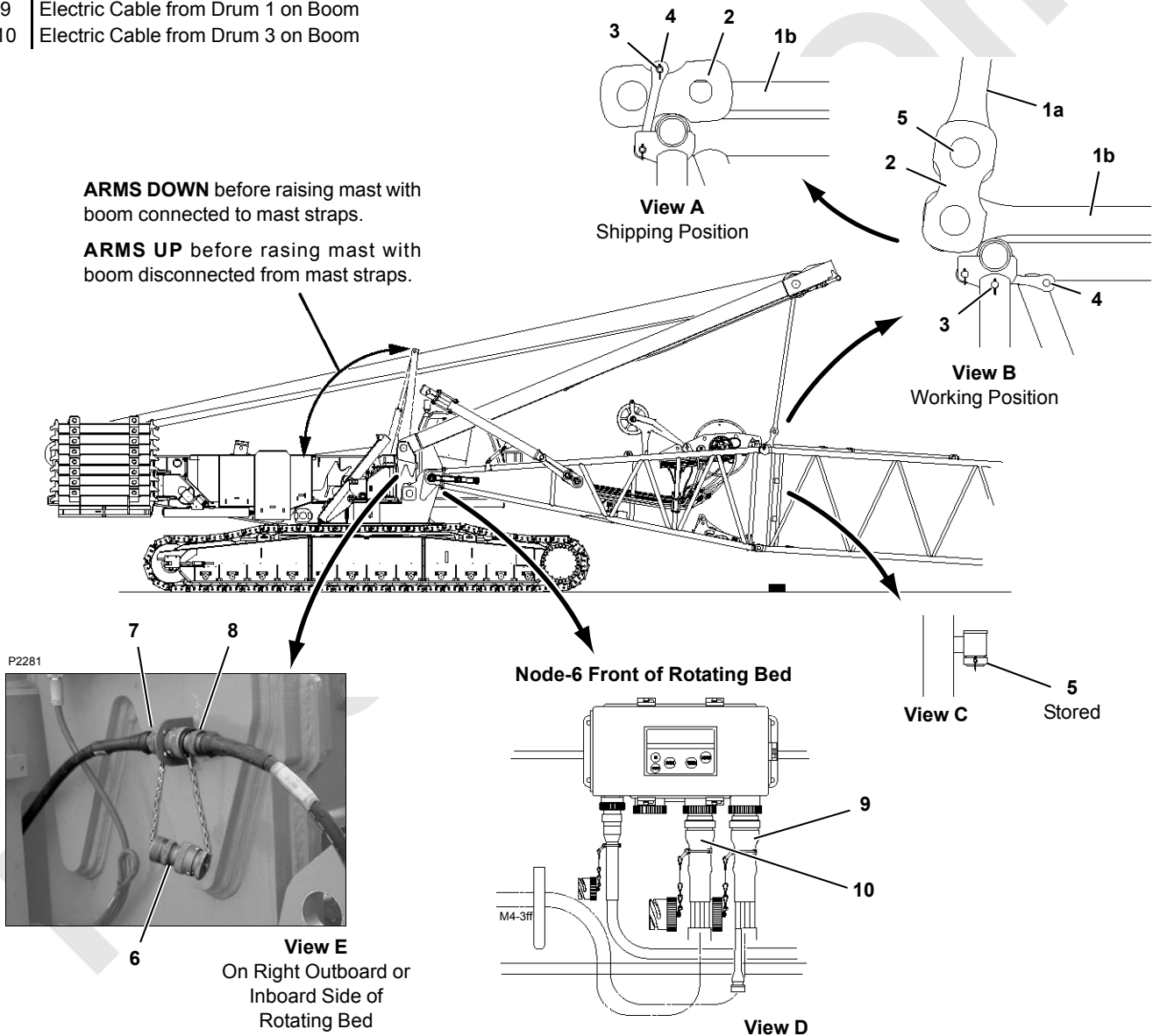


FIGURE 4-20



See [Figure 4-20](#) for the remaining steps.

9. Connect the electric cable from the crane to the controller on the boom butt:
  - a. Remove the terminator plug (6, View E) from the electric cable (3) on the crane.
  - b. Connect the electric cable (8) from the boom butt to the cable (3).
10. Connect the electric cables 9 (View D) and 10 (optional) from the boom butt to the node on the front of the rotating bed.
11. Lower the mast until the ends of the mast straps (1a) are approximately 457 mm (18 in) from the boom.
12. Connect the mast straps (1a, View B) to the insert straps (1b):
  - a. Remove the pins (3, View A) and rotate the links (4) to the working position (View B).
  - b. Pin the links (4, View B) in the working position.
  - c. Remove the pins (5, View C) from storage.
  - d. Rotate the links (2, View A) up and pin them to the mast straps (1a) with the pins (5, View B). Lower the mast as required to align the holes.



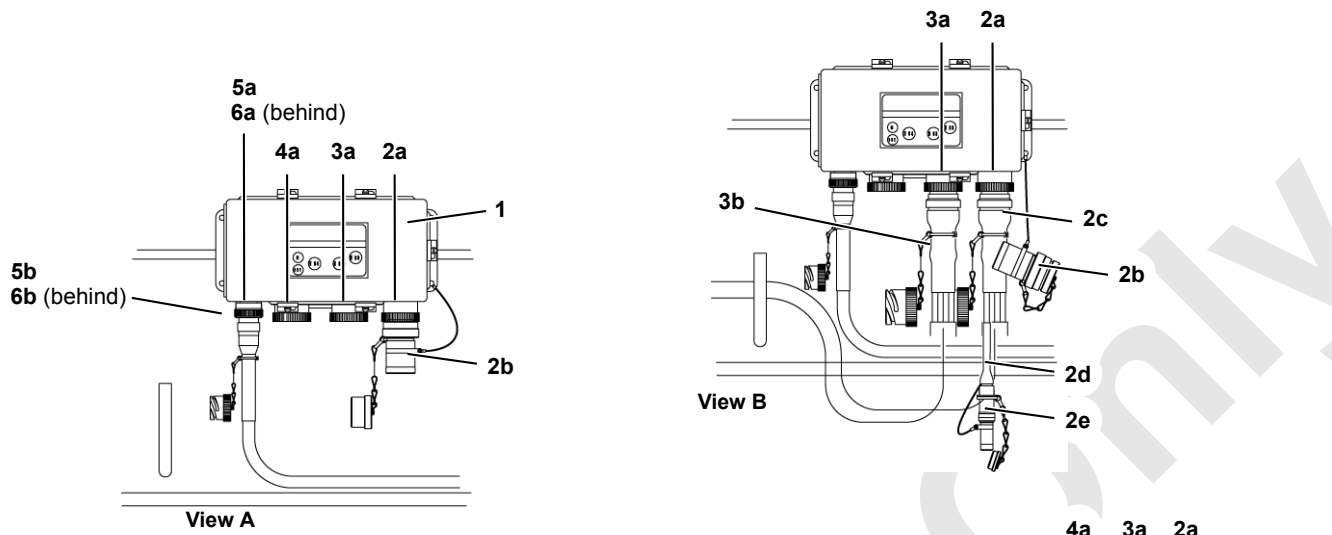
## DANGER

### Falling Mast/Boom Hazard!

Prevent the mast and boom from falling:

- Fully lower the mast arms before raising the boom.  
***The mast can buckle and collapse if it contacts the mast arms with a fully rigged boom.***
- 
13. Fully lower the mast arms using the switch on the remote control.
  14. Turn off and store the setup remote control.
  15. Select the proper capacity chart on the RCL display configuration screen.
  16. The boom can now be raised. ***Before raising the boom, perform the pre-raising checks.***
  17. The boom can now be raised.

Node-6 Electrical Connections For MAX-ER With Mast Stop Limit Switch



Legend for [Figure 4-21](#)

Item	Component	Description
1	Node 6	Front of Rotating Bed
2a	Receptacle W66	Drum 1 in Boom Butt
2b	W66 Shorting Plug w/ Dust Cap	
2c	Cable W66	
2d	Cable W66P8	
2e	W66P8 Shorting Plug w/ Dust Cap	
3a	Receptacle W63	Drum 3 in Boom Butt
3b	Cable W63	
4a	Receptacle W64	Drum 5 in Mast Butt
4b	Cable W64	
4c	Cable W64P8	
5a	WN In	
5b	Cable WN24 or WN26	From Wireless Setup Receiver
6a	WN Out	CAN Out
6b	Cable WN18	From Node 3

FIGURE 4-21

## NODE-6 CONFIGURATION

See [Figure 4-21](#) for the following procedure.

### Shipping Configuration

To configure Node-6 for shipping, connect the terminating plug (2b, View A) to the Node-6 receptacle (2a).

### Working Configuration with Boom

To configure Node-6 for operation, use the following:

1. Disconnect the terminating plug (2b, View A) from the receptacle (2a). Connect the sealing cap to the end of the terminating plug and let the terminating plug hang freely.
2. Connect the electric cable (2c, View B) from the boom butt to the receptacle (2a).
3. Connect the terminating plug (2e, View B) to the electric cable (2d).
4. If the crane is equipped with a luffing hoist, connect the electric cable (3b, View B) to the receptacle (3a).

### Working Configuration with MAX-ER

To configure Node-6 with a MAX-ER, use the following:

1. Disconnect the terminating plug (2b, View A) from the receptacle (2a). Connect the sealing cap to the end of the terminating plug and let the terminating plug hang freely.
2. Connect the electric cable (2c, View B) from the boom butt to the receptacle (2a).
3. Connect the terminating plug (2e, View B) to the electric cable (2d).
4. If the crane is equipped with a luffing hoist, connect the electric cable (3b, View B) to the receptacle (3a).
5. Disconnect the terminating plug (2e, View B) from the electric cable (2d). Connect the sealing cap to the end of the terminating plug and let the terminating plug hang freely.
6. Connect the electric cable (4b, View C) from the mast butt to the receptacle (4a).
7. Connect the electric cable (2d, View C) to the electric cable (4c).

## CRANE DISASSEMBLY

### Lower Boom

Perform steps [1](#) through [4](#) under the Boom Removal topic to lower the boom and jib (if equipped).

## Disconnect Boom Butt from Boom

To disconnect the boom butt, use the following:

1. Disconnect the boom wiring:
  - a. Disconnect the boom electric cable (8, [Figure 4-20](#), View E) from the crane electric cable (7).
  - b. Remove the sealing cap and connect the terminator plug (6, View E) to the electric cable (7). See [Figure 4-5](#), View D.
  - c. Connect the sealing cap to the electric cable (8) and store the electric cable (8) on the boom butt.
  - d. Disconnect the electric cables 9 ([Figure 4-20](#), View D) and 10 (optional) from the node on front of the rotating bed.
  - e. Connect the sealing caps to the electric cables (9 and 10) and store the cables in the boom butt.
  - f. Disconnect the electric cable from the cable reel in the butt at the controller on the boom butt and at the controller on the boom top.
  - g. Coil the cable onto a cable reel.
2. Disconnect the mast straps from the boom (see [Figure 4-20](#)):
  - a. Lower the mast until the straps (1b) for the insert next to the butt are resting on the insert per View B.
  - b. Unpin the links (2, View B) from the mast straps (1a) and store the links (2) and straps (1b) per View A.
  - c. Store the pins (5) in the insert pockets (View C).
3. Fully raise the mast arms using the switch on the remote control.



### DANGER

#### Falling Mast/Boom Hazard!

Prevent the mast from falling:

- Fully raise the mast arms before raising the mast. The mast will fall backward if raised to vertical with the arms down.

4. Disconnect the boom butt:

See [Figure 4-19](#) for the following procedure:



### DANGER

#### Falling Boom Hazard

Do not remove the bottom pins between the butt and insert until the handling pendants are connected and supporting the boom. The boom will collapse.

- a. Unpin the handling pendants (6, View A) from the mast and pin them to the lugs on the boom butt (View D).
- b. Boom up until the handling pendants (6, View F) are taut.

**WARNING****Falling Boom Hazard**

Do not attempt to lift the assembled boom with the handling pendants. The handling pendants could break, allowing the boom to fall.

- c. Remove the pins (12, View G).
- d. Slowly boom down to lower the boom onto blocking at least 152 mm (6 in) (View C).
- e. Boom down until the hooked connectors (10, View E) in the boom butt disengage the fixed pins (11) in the adjacent insert.
- f. Travel backward until the crane is clear of the boom with enough room to install the assembly block.
- g. Lower the boom butt onto blocking.
- h. Unpin the handling pendants (6, View D) from the boom butt.

**Install Assembly Block**

See [Figure 4-19](#) for the following procedure:

**WARNING****Falling Mast Hazard!**

Prevent the mast from falling:

- Do not use the limit bypass to lower the mast below 156° until the ***mast is supported with slings from the assist crane.***

1. Position the trailer carrying the assembly block (5) at the end of the boom butt as shown in View B.
2. Boom down to lower the mast (3) to approximately 160°.
3. Pin the handling pendants (6) to the assist crane block (7) with the nylon lifting slings (8).
4. Support the mast using the assist crane.
5. Lower the mast to the desired position using the assist crane. ***Do not side load the mast.***

Use the limit bypass switch to bypass the mast limit and pay out the boom hoist wire rope as the assist crane lowers the mast.

**WARNING****Crush Hazard!**

Do not stand or work under the mast unless it is supported by the assist crane.

**CAUTION****Equipment Damage!**

To prevent damage, guide the mast straps (9) clear of the trailer as required.

6. Reeve the wire rope from the whip drum through the sheaves in the mast point and assembly block (see [Figure 4-9](#), View B).
7. Anchor the wire rope to the socket and wedge on the load block (see the Wire Rope Installation and Maintenance topic in this section).
8. Connect the 4-leg chain sling (4) to the assembly block.
9. Raise the mast to at least 156° using the assist crane. As the mast is raised, use the following:
  - Pay out the load line from the whip drum.
  - Haul in the wire rope on the boom hoist.
10. Once the mast is at or above 156°, support the mast using the boom hoist wire rope and disconnect the handling pendants (6) from the assist crane block.
11. Pin the handling pendants to the mast for storage (View A).
12. Haul in the load line on the whip hoist to lift the assembly block off trailer. ***Take every precaution to prevent the block from swinging into the end of boom butt, which could cause damage.***
13. Position the mast in the operating range (see [Figure 4-8](#)).

**Remove Boom Butt**

See [Figure 4-17](#) for the following procedure:

1. Lower the wire rope guide to the shipping position (View A):
  - a. Attach the lifting sling from the assembly block to the lifting lug (3, View A) on the wire rope guide (2).
  - b. Support the wire rope guide so the pins (4) are loose and remove the pins.
  - c. Lower the wire rope guide from the operating position to the shipping position.

- d. Install the pins (4).
  - e. Disconnect the lifting sling.
2. Disconnect the hydraulic hoses between the boom butt and the rotating bed (see [Figure 4-18](#)):
    - a. **Thoroughly clean each coupler** and connect dust covers to the couplers to prevent dirt accumulation.
    - b. Unpin and move the retaining bar (2) out of the way.
    - c. Swing the hydraulic hoses (6 and 7) backward into the notches on the rotating bed (View D).
    - d. Pin the retaining bar in position to retain the hoses (View D).
  3. Attach lifting slings from the assembly block to the lifting lugs in the top chords of the boom butt as shown in [Figure 4-17](#), View D.
  4. Disconnect the hydraulic hoses (5a, View B) from the couplers (5b) in the boom butt.
 

**Thoroughly clean couplers to prevent dirt from entering the hydraulic system.**
  5. Connect the hydraulic hoses (5a, View C) to the couplers (5c) on the left side of the rotating bed.
  6. Remove the locking pins (7, View E) from the operating position and install them in the shipping position.
  7. Attach hand-held taglines to the butt so it can be stabilized when the pins are disconnected.
  8. Lift the butt clear of the ground (View D).

**WARNING****Moving Load Hazard!**

Warn personnel to stand clear of the boom butt. The butt may swing out away from the crane when the pins are disengaged.

9. Using the setup remote control, disengage the boom hinge pins (6, View E, [Figure 4-17](#)).
10. Stabilize the butt with the taglines and pull the butt away from the rotating bed.
11. Using the setup remote control, engage the boom hinge pins (6, View E).
12. Disconnect hydraulic hoses (5a, View C, [Figure 4-17](#)) from couplers (5c) on rotating bed and connect to couplers (5b, View B) in butt.

**CAUTION****Boom Hinge Pin Damage!**

Step [12](#) must be performed to relieve trapped pressure in boom hinge pin cylinders. Otherwise, damage to parts can occur.

13. Lift the butt onto the transport vehicle.
14. Disconnect the slings.

**Disassemble Boom**

The boom can now be disassembled using the live mast.

See the Liftcrane Mast Capacities Chart at the end of this section for lifting capacities.

**Remove Counterweight****WARNING****Tipping Hazard!**

To prevent the crane from tipping, remove the crane counterweight before removing the carbody counterweight.

**Remove Crane Counterweight**

The crane counterweight must be removed using an assist crane.

See [Figure 4-16](#) for the following procedure:

1. Remove the counterweight side boxes (2, View F) one box at a time, alternating from side to side.
2. Uncoil the handling pendants (3, View B) from the storage pockets in the tray (1) and hook the pendants to the assist crane load block (View C).

**WARNING****Falling Load Hazard!**

The pendants are designed to handle the counterweight tray only.

Do not attempt to lift the tray with the counterweight boxes installed. The pendants could break, allowing the counterweight tray and boxes to fall.

3. Hoist up using the assist crane until the handling pendants are taut.
4. Remove the hitch pins (7, View E) from the counterweight pins (6) and install the hitch pins in the storage lugs.

5. Disengage the counterweight pins (6) using the switch on the remote control. The pins will engage if the switch is released.
6. Travel, swing, and lower the load as required using the assist crane to disengage the counterweight tray from the hooks (5) in the rotating bed (View D).
7. Lower the counterweight tray onto the ground at the rear of the crane.  
Release the switch on the remote control to engage the counterweight pins (6, View D) once the tray is clear of the pin holes.
8. Disconnect the hydraulic hoses from the counterweight cylinders at the couplers (4, View A) on the rear of the rotating bed.  
Coil the hydraulic hoses on the tray for storage.
9. Lift the counterweight tray onto the transport vehicle.
10. Unhook the handling pendants from the assist crane hook. Coil the pendants in the storage pockets (View B).

**WARNING****Tipping Hazard!**

To prevent the crane from tipping, remove the crane counterweight before removing the carbody counterweight.

**Remove Carbody Counterweight**

See [Figure 4-14](#) for the following procedure.

The carbody counterweight can be removed with the live mast when the crane is in the following configuration:

- Mast assist arms fully raised. The mast will be at approximately 105° with the assist arms supporting the mast when attaching the carbody counterweights.
- Liftcrane Mast Capacities Chart selected on the RCL configuration screen.
- 360° swing permitted while handling the counterweight.
- Mast operated within the limits of the Liftcrane Mast Capacities Chart at the end of this section.

**Remove Side Boxes**

To remove the side boxes, use the following procedure:

1. For **Series 3 only**, remove each side box:
  - a. Attach the crawler handling shackles to the lifting lugs (3) on the side box (2).

- b. Attach the legs of the chain sling to the shackles.
  - c. Lift against the side box until the chain sling legs are taut.
  - d. Unpin the side box from the center box. Store the pins in the side box holes.
  - e. Lift the side box onto the transport vehicle.
  - f. Disconnect the chain sling and remove the shackles.
  - g. Repeat steps through f for the other side box.
2. For **Series 2 and 3**, use the following:
    - a. Attach the crawler handling shackles to the lifting lugs (3) on the center box (1).
    - b. Attach the legs of the chain sling to the shackles.
    - c. Unpin and remove the center box (6, View B). Store the pins in the center box holes.
    - d. Boom, hoist, and swing as required to disengage the slots (4, View C) in the top of the center box from the hooks (5) on the carbody.
    - e. Lift the center box onto the transport vehicle.
    - f. Disconnect the chain sling and remove the shackles.
  3. Repeat steps 1 and/or 2 at the other end of the carbody.
  4. Attach the shackles to the crawlers for storage.

**Remove Crawler Stairways**

See [Figure 4-15](#), View C for the following procedure.

If necessary, remove each crawler stairway using the following:

1. Attach nylon slings from the assembly block on the live mast to the stairway (6).
2. Hoist as required to support the stairway.
3. Remove the quick-release pins (8). Store the pins in the platform holes once the stairway is removed.
4. Slide the stairway out of the sleeves (7) on the underside of the platform.
5. Lift the stairway onto the transport vehicle and disconnect the slings.

**Store Crawler Platforms**

See [Figure 4-15](#), View B for the following procedure:

1. Remove the safety pins (3) from the ends of the platform extensions (1a).
2. Rotate the platform extensions (1a) to the stored position and install the safety pins (3).

3. Remove the hitch pins (4) and push the supports (2) in.
4. Install the hitch pins (4).

## Remove Crawlers

The crane must be in the following configuration to remove the crawlers:

- Mast arms fully raised
- Liftcrane Mast Capacities Chart selected on the rated capacity configuration screen
- Mast operated within the limits of the Liftcrane Mast Capacities Chart at the end of this section



### WARNING

#### Tipping Hazard!

To avoid tipping, use the following precautions:

- Do not exceed the capacities given in the Liftcrane Mast Capacities Chart when handling the crawlers with the mast. The crane will tip forward.
- Make sure the crane is level. Check the 2-way level on the front of the carbody. Adjust the jacks as required.
- Do not swing 10° or more to either side of center (see [Figure 4-9](#)).

### CAUTION

#### Parts Damage!

Avoid hitting the carbody jacks with the crawlers.

### Remove First Crawler

See [Figure 4-13](#) for the following procedure.

Perform steps [1](#) through [4](#) for both crawlers:

1. Disconnect the hydraulic hoses ([Figure 4-11](#)) between the carbody and crawler:
  - Connect hose 11 (View A) to coupler 12
  - Connect hose 12 (View B) to coupler 11a
  - Attach the dust cap to the end of the hose (13, View B) and to the coupler (13a). Secure the hose to the carbody for shipping
2. Disconnect the grease hose (14, [Figure 4-11](#), View C) between the carbody and crawler:
  - Attach the dust cap to the end of the hose and the coupler (14a)
  - Secure the hose to the carbody for shipping

3. Disconnect the crawler drive (see [Figure 4-13](#)):
  - a. Unpin the drive shaft guard (9, View D) and slide the guard back.
  - b. Support the drive shaft (4, View C) and remove the flange screws (8). Store the screws in the carbody flange holes when the drive shaft is disconnected.
  - c. Retract the crawler drive shaft and place it on the storage bracket (5, View B).
4. Attach chains (1, [Figure 4-13](#), View F) between the crawler pads (2) and crawler lugs (3) (four places). The chains should be snug to prevent treads from sagging when the crawler is lifted.
5. Perform steps [3](#) through [7](#) on [page 4-9](#) to deploy each carbody jack.



### WARNING

#### Moving Part Hazard!

To avoid a serious crushing injury, warn all personnel to stand clear of the jacks.

#### Tipping Hazard!

To avoid tipping the crane over, keep the crane level while jacking.

6. Using the controls on the front of the carbody, extend the carbody jacks until the crawler treads clear the ground.
7. Use the 2-way level near the controls on the front of the carbody to aid in jacking.
8. Attach the hooks from the chain sling ([Figure 4-13](#), View E) to the crawler as shown in [Figure 4-10](#).
9. Tilt the operator cab up as required so the crawler does not hit the cab.
10. Remove the collars (3, [Figure 4-12](#), View D) and retract the crawler connecting pins (2) using the crawler pins control (4 or 5, View G).



### DANGER

#### Tipping Hazard!

Do not allow the assembly block to swing past the inside edges of the carbody jacks while removing the first crawler. The crane will tip.

11. Slowly hoist and boom up or down as required to lift the crawler clear of the carbody.
12. Position the trailer under the suspended crawler.
13. Lower the crawler onto the trailer.

14. Disconnect the chains from the crawler and remove the trailer.
15. Engage the crawler pins and install the collars (3, [Figure 4-12](#), View D).

### Remove Second Crawler



#### WARNING

##### Tipping Hazard!

To prevent the crane from tipping, do not swing 10° or more to either side of center when handling the second crawler ([Figure 4-9](#), View E).

To remove the second crawler, use the following:

1. Swing 180° so the assembly block from the mast is centered over the crawler.
2. Repeat steps 8 through 15 of the Remove First Crawler topic for the second crawler.

**Do not swing more than 10° to either side of center when handling the second crawler.**

### Remove Assembly Block

Follow the instructions on [page 4-33](#).

### Lower Live Mast to Shipping Position

See [Figure 4-8](#) for the following procedure:



#### WARNING

##### Falling Mast Hazard!

Do not raise the mast to 115° until the mast assist arms are fully raised. The mast will fall over backward.

1. Select the Liftcrane Mast Capacities Chart.
2. Increase engine speed to the desired RPM.
3. If required, fully raise the mast assist arms using the mast switch on the remote control.
4. Boom up using the boom hoist control to lower the live mast (1) to the shipping position.  
The mast assist arms will support the mast as the cylinders retract automatically.
5. Release the boom hoist control when the mast comes to rest on the supports at the rear of the rotating bed.

6. Fully lower the mast assist arms using the mast switch on the remote control.
7. Unpin the cab strut from the lug on the cab support and rotate the operator cab 90° from the operating position (View A):
  - a. Use the cab raise/lower switch on the remote control to raise or lower the cab to the shipping position (View A).
  - b. Pin the cab strut to the lug on the rotating bed (View A).
  - c. On top of the cab, remove the amber beacon screws and move the beacon to the shipping (horizontal) position. Remove the radio antenna.
8. Shut down the engine.

### Install Crane on Trailer

See [Figure 4-6](#) for the following procedure.

To install the crane on the trailer use the following steps:

1. Extend the carbody jacks fully to provide clearance for the trailer.

#### CAUTION

##### Equipment Damage!

Use extreme care not to hit the jacks with the trailer when backing the trailer into position:

Provide a signal person to give instructions to the truck driver.

2. Center the trailer under the carbody.
3. Slowly retract the jacks to lower the crane on the trailer.
4. Block both ends of the crane so it is firmly supported and fully retract the jacks.
5. Store the jack pads (View B).
6. Store each carbody jack:
  - a. Remove the connecting pin from the working hole (View C).
  - b. Swing the jack in.
  - c. Install the connecting pin in the storage hole (View C)
7. Rotate the operator cab to the shipping position and secure it with the strut ([Figure 4-7](#)).



Reference Only

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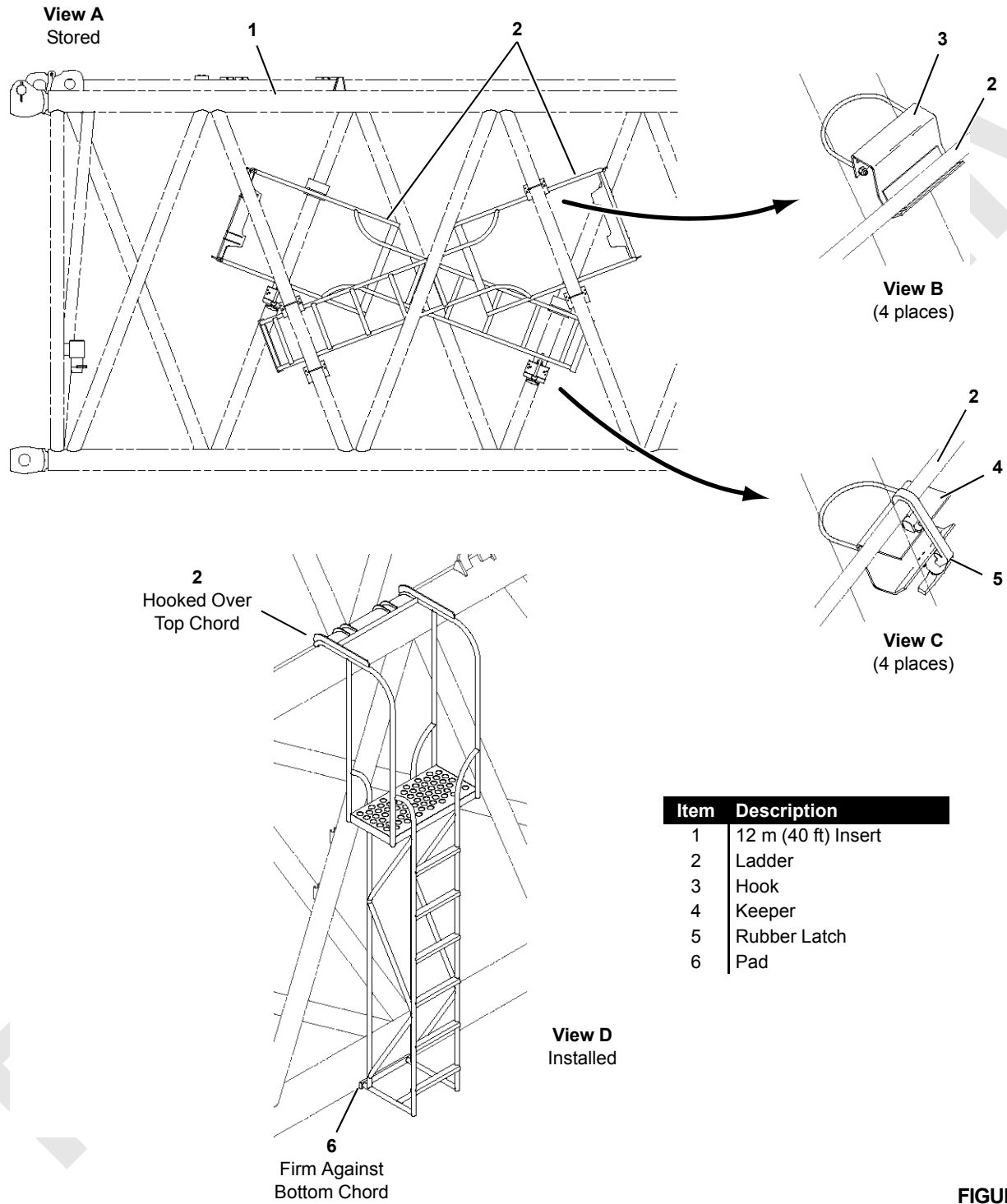


FIGURE 4-22

## BOOM LADDER ASSEMBLY

See [Figure 4-22](#) for the following procedure.



### WARNING

#### Risk of Serious Injury or Death:

To prevent serious injury or death, use the following precautions:

- Limit the load on the ladder to 136 kg (300 lb).
- Avoid improper ladder use. The ladder is intended for use only on Manitowoc #58 boom inserts. Any other use is prohibited.
- Use the ladder for boom assembly/disassembly and maintenance only when the boom is horizontal.
- Make sure the ladder is properly secured to the insert.
- Keep all hands free of any objects while climbing the ladder. Objects that cannot be carried in pockets or tool belts must be lifted into place on the ladder platform prior to climbing the ladder.
- Stand only on the platform. Do not stand on the cross braces.

Two ladders (2) are stored inside the 12 m (40 ft) heavy insert (1) as shown in View A. The ladders are designed for use in assembly/disassembly and maintenance of the #58 boom sections and components. Each ladder weighs approximately 7 kg (15 lb).

### Removing Ladders from Boom Butt

Two people should remove either ladder from the boom insert: one person inside the insert to unlatch and lift the ladder, and another person outside the insert to help guide the ladder out of the insert. Use the following:

1. Lower the boom onto blocking at ground level. Boom sections must be horizontal.
2. Unhook the rubber latches (5, View C).
3. Lift the ladder (2) up and out of the hooks (3, View C).
4. Guide the ladder through the lacings and outside the insert.

### Installing Ladders on Boom Inserts

Lift either ladder (2) to the desired outside location on the insert so the ladder is securely hooked over the back of the upper chord and the lower pad (6) is firm against the lower chord (View D).

The ladder must hang vertically against the boom insert when in use.

### Storing Ladders in Boom Butt

Two people should store either ladder in the boom insert: one person outside the insert to help guide the ladder into the insert, and another person inside the insert to lift the ladder and latch it in position. Use the following:



### WARNING

#### Falling Load Hazard!

Ladders must be properly stored to prevent them from falling out of the insert when the boom is raised.

1. Hang the ladder rails over the hooks (3, View B) inside the insert.
2. Pull the rubber latches (5) tightly over the lower rails and latch them in the keepers (4, View B).
3. Make sure the ladder cannot move once latched.

## BOOM RIGGING

### Assist Crane Requirements

Either the live mast or an assist crane can be used to handle and assemble the boom section. See the Crane Weights topic in Section 1 for the weights of boom sections.

### Blocked Crawler

To prevent the crane from tipping, some boom and jib lengths must be raised and lowered over the end of blocked crawlers. See the capacity charts for blocked crawler requirements and the Crawler Blocking Diagram in the Capacity Charts Manual for instructions.

Do not attempt to raise or lower the boom from or to the ground until the crawlers are blocked, if required.



### WARNING

#### Tipping Hazard

Block the ends of the crawlers, if required, before attempting to raise or lower the boom from or to the ground.

### Handling Components

Handle the boom and jib sections with care to avoid damaging lacings and chords. The boom and jib sections have lifting lugs designed to provide a balanced load and to prevent damage during lifting.



### WARNING

#### Falling Load Hazard!

Lifting lugs on a particular boom or jib section are designed only for lifting that section. Do not attempt to lift two or more boom or jib sections with only the lifting lugs on one section. Lifting lugs may break, allowing the boom or jib sections to fall.

When lifting lugs are not used, use the following precautions:

- Lift against chords only and never against lacings.
- Use nylon lifting slings. If wire rope or chain slings are used, install a protective covering (such as sections of rubber tire) between the slings and chords.

### Boom Assembly Drawing

Boom sections (top, inserts, straps) must be assembled in the proper sequence according to the Boom Assembly drawing at the end of this section.



### WARNING

#### Collapsing Boom Hazard!

The boom can collapse if not assembled in the correct sequence. Follow the assembly sequence in the Boom Assembly drawing.

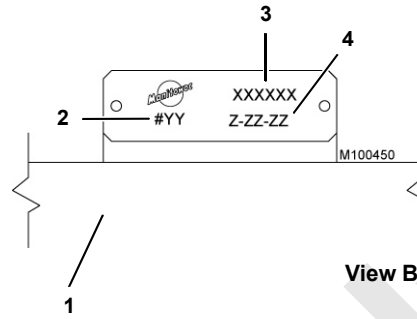
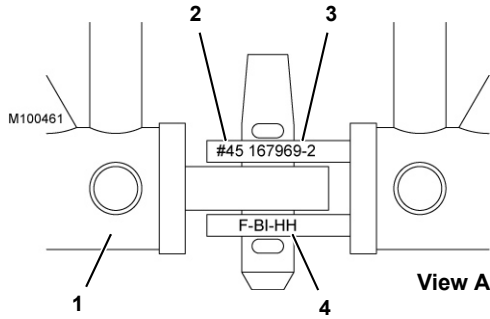
### Identifying Boom Sections and Straps

Boom and jib sections are marked for proper identification as shown in Views A and B, [Figure 4-23](#).

Boom and jib pendants are marked for proper identification as shown in View C, [Figure 4-23](#).

Boom straps and links are marked for proper identification as shown in View D, [Figure 4-23](#).

**NOTE:** The markings shown in [Figure 4-23](#) can vary depending on when your crane was produced and the original equipment manufacturer.



Item	Description
1	Boom or Jib Chord
2	Boom or Jib Number
3	Manitowoc Part Number
4	Manitowoc Manufacturing Code
5	Pendant
5a	Aluminum Tag (if equipped)
6	Manitowoc Purchase Order Number
7	Manufacturer's Number
8	Wire Rope Type
9	Diameter
10	Length
11	Set Number
12	Strap or Link

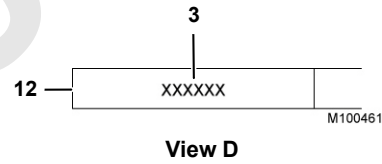
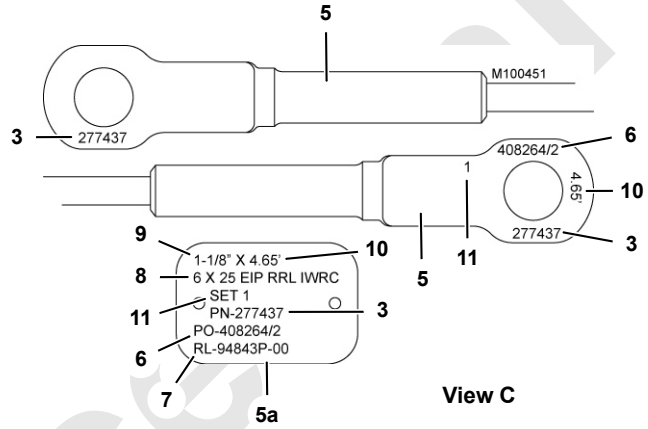
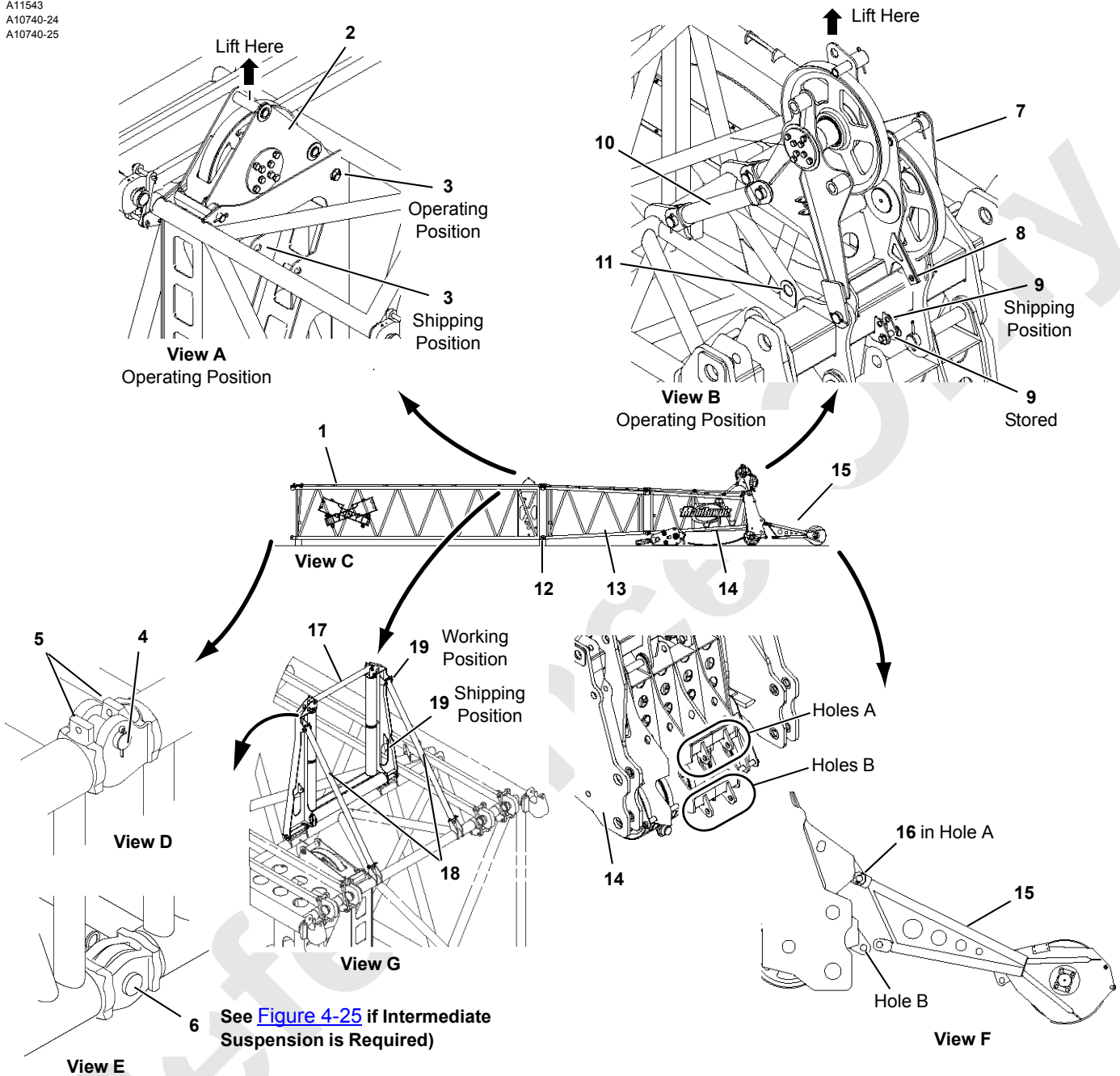


FIGURE 4-23

Reference

A11388  
A11543  
A10740-24  
A10740-25



Item	Description	Item	Description
1	12 m (40 ft) Insert	11	Lug
2	Wire Rope Guide	12	Inserts
3	Pin with Snap Pins	13	Transition Insert
4	Fixed Horizontal Pin	14	Boom Top
5	Hooked Connector	15	Upper Boom Point Assembly
6	Bottom Connecting Pin	16	Pin with Snap Pins
7	Wire Rope Guide	17	Wire Rope Guide (Working Position)
8	Shipping Lug	18	Wire Rope Guide Struts
9	Pin with Snap Pins	19	Safety Pins
10	Strut		

FIGURE 4-24

**WARNING****Crushing Injury Hazard!**

Never work under or inside boom sections that are not securely blocked.

**WARNING****Falling Load Hazard!**

Luffing jib backstay straps can be stored on the boom sections for shipping.

If a jib will not be used, remove all jib backstay straps, links, and pins stored on the boom sections.

**Assemble Boom Sections**

See [Figure 4-24](#) for the following procedure.

**Boom sections must be assembled in the proper sequence.** See the Boom Assembly drawing at the end of this section for the assembly sequence:

1. If the luffing jib will not be used, remove all jib backstay straps, links, and pins stored on the boom sections.
2. Place the 12 m (40 ft) heavy insert (1) on blocking approximately 152 mm (6 in) high. This insert has a sheave frame at the top end of the insert.

**NOTE:** Each boom section has four lifting lugs in the top chords.

**WARNING****Pinch Point Hazard!**

Keep all hands clear of openings in the wire rope guide frame while raising or lowering the wire rope guide in step 3.

3. If required for the luffing jib or auxiliary drum, raise the wire rope guide (2, View A) to the operating position:
  - a. Attach a sling to the rope guide pin.
  - b. Support the wire rope guide with the hoist and remove the pin (3) from the shipping position.
  - c. Raise the wire rope guide to the operating position and install the pin (3).

4. Lift the next insert into position and engage the fixed horizontal pins (4, View D) in the insert with the hooked connectors (5) in the adjacent insert.

5. Lower the insert to horizontal and install both bottom connecting pins (6, View E).

**NOTE:** If intermediate suspension is required, standard bottom connecting pins (6) are replaced with longer connecting pins and links (see [Figure 4-25](#) and Boom Assembly drawing).

6. Block under the top end of the insert.

7. Repeat steps 4 to 6 for each remaining insert (12) and the boom top (14).

**NOTE:** A transition insert (13) must be installed next to the boom top (14).

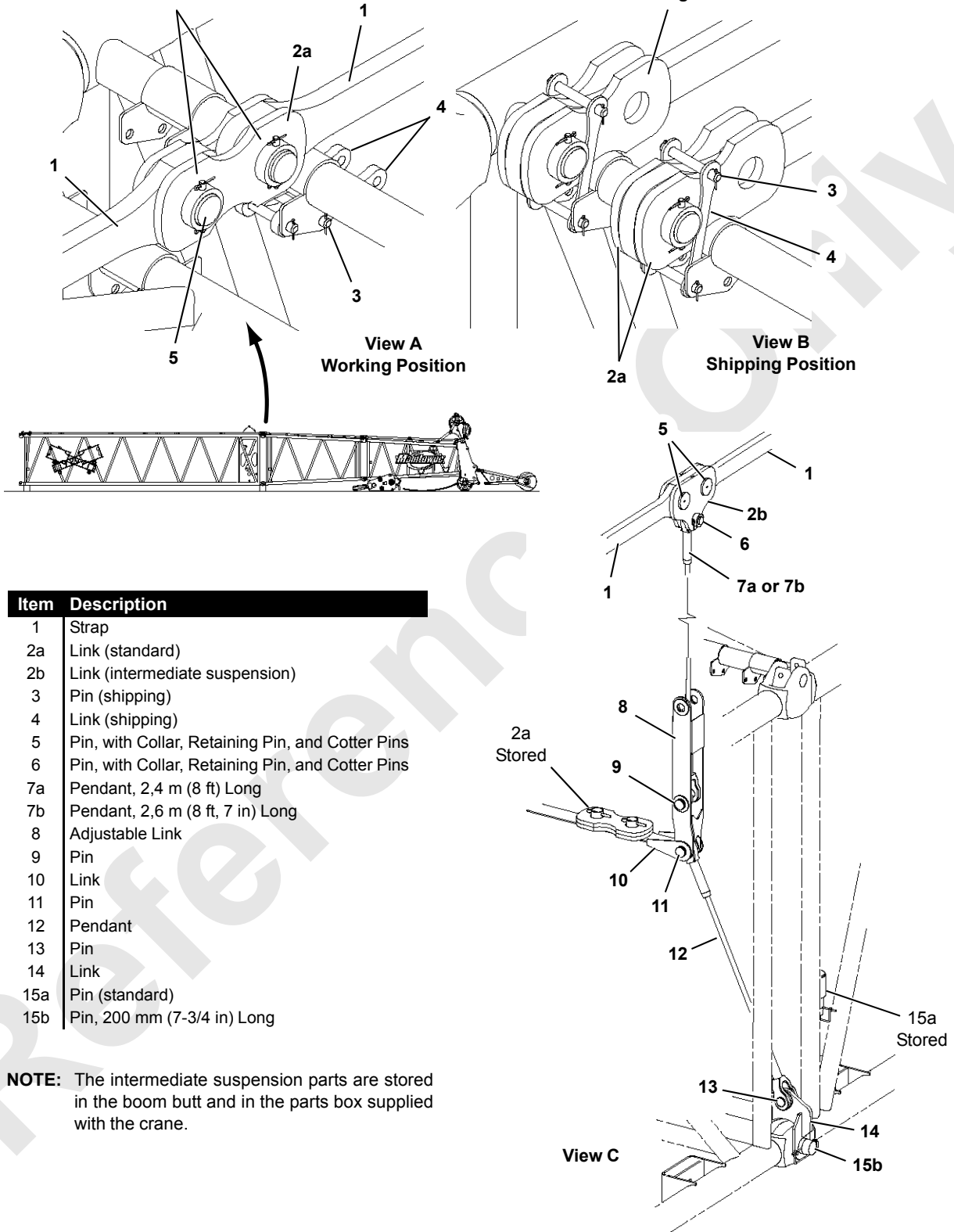
8. Raise the boom top wire rope guide (7, View B) to the operating position:
  - a. Attach a sling to the hole in the rope guide.
  - b. Support the wire rope guide using the hoist and remove the pin (9) from the shipping position.
  - c. Raise the wire rope guide to the operating position.
  - d. Store the pin (9).
  - e. Unpin the struts (10) from the storage lugs (11) and pin them to the wire rope guide.

9. Raise the wire rope guide (17, View G) to the working position:
  - a. Remove the safety pins (19) from the shipping position.
  - b. Rotate the wire rope guide up to the working position.
  - c. Support the guide and secure it to the struts (18) with the safety pins (19).

A11543-1  
A11543-2

Collars Toward Inside  
of Boom Sections

Luffing Jib Straps, Links, and All Hardware Must Be  
Removed if Luffing Jib is Not Used



Item	Description
1	Strap
2a	Link (standard)
2b	Link (intermediate suspension)
3	Pin (shipping)
4	Link (shipping)
5	Pin, with Collar, Retaining Pin, and Cotter Pins
6	Pin, with Collar, Retaining Pin, and Cotter Pins
7a	Pendant, 2,4 m (8 ft) Long
7b	Pendant, 2,6 m (8 ft, 7 in) Long
8	Adjustable Link
9	Pin
10	Link
11	Pin
12	Pendant
13	Pin
14	Link
15a	Pin (standard)
15b	Pin, 200 mm (7-3/4 in) Long

**NOTE:** The intermediate suspension parts are stored in the boom butt and in the parts box supplied with the crane.

FIGURE 4-25



### Connect Boom Straps

See [Figure 4-25](#) for the following procedure.

The boom straps and links are shipped on the boom sections as shown in View B:

1. Connect the straps (1, View A) at the top end of the butt and each insert:
  - a. Remove the pins (3, View B) and rotate the links (4) to the working position (View A).
  - b. Pin the links (4, View A) in the working position.
  - c. Remove the pin (5, View A) from the end of each strap (1).
  - d. Rotate the links (2a, View B) backward and pin them to the adjacent strap with the pin (5, View A).

**NOTE:** If intermediate suspension is required (see Boom Assembly drawing), use the links shown in View C (2b) in place of the links shown in View A (2a).

Store the links shown in View A (2a) on link 10 (View C).

### Install Intermediate Suspension

See Figures [4-25](#) and [4-26](#) for the following procedure:

**NOTE:** Intermediate suspension is required at locations specified in the Boom Assembly drawing.

1. If not done, replace the links shown in View C (2b) with the links shown in View A (2a).

See View C for the remaining steps.

2. If not done, remove and store the standard pin (15a).
3. Using the intermediate suspension pin (15b), install the link (14) and reconnect the inserts.
4. Attach the pendant (12) to the link (14) with the pin (13).
5. Connect the pendant (12) and either the adjustable link (8) or pendant (7a or 7b) to the link (10) with the pin (11).
6. If the adjustable link (8) is required, pin the pendant (7a or 7b) to the adjustable link with the pin (9).

**Pin the pendant to the proper holes in the adjustable link as specified in [Figure 4-26](#).**

7. Pin the pendant (7a or b) to the links (2b) with the pin (6).
8. Repeat steps [1](#) through [7](#) on the other side of the insert.

When the boom is raised, the boom straps will lift the intermediate suspension into position and support the inserts.

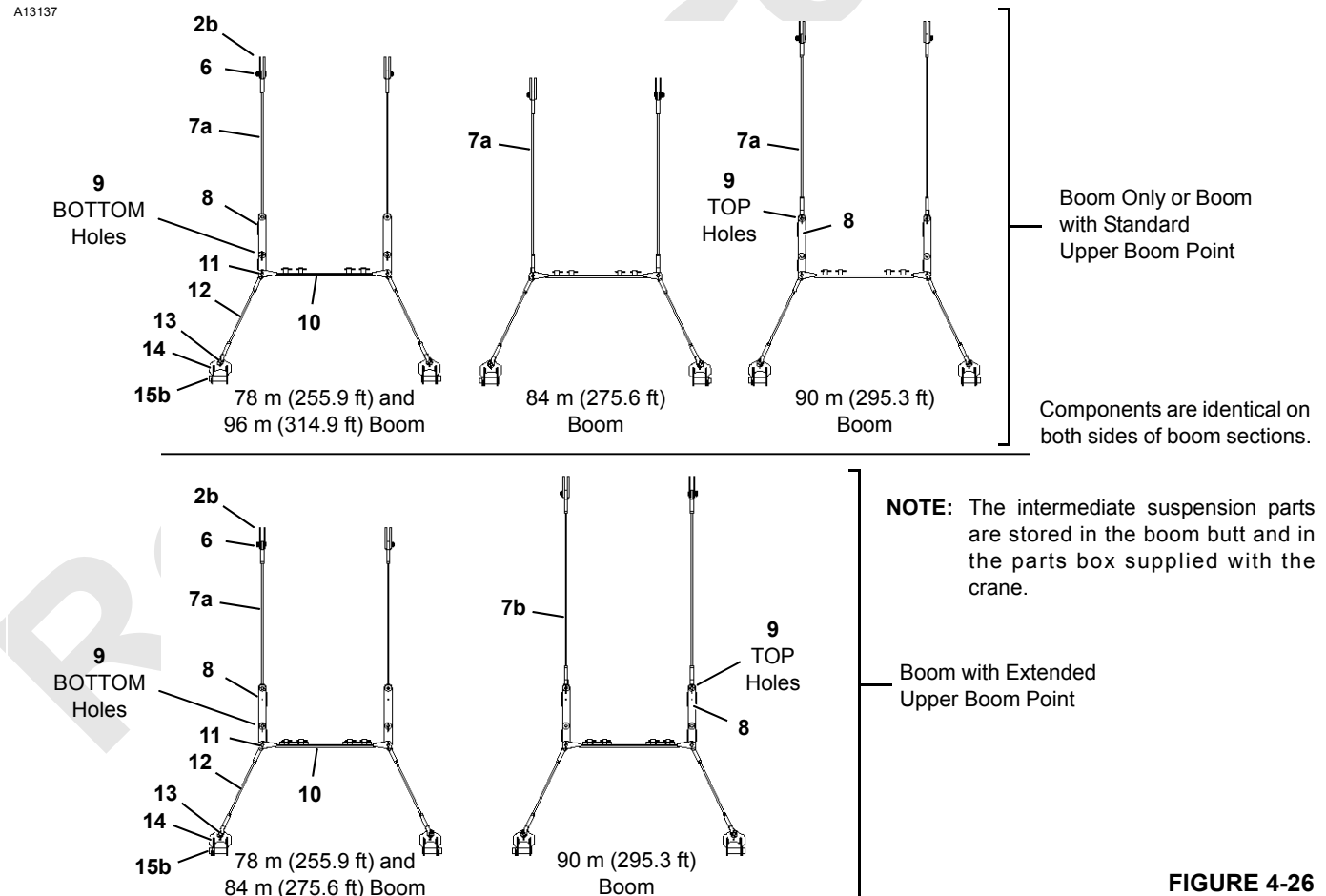
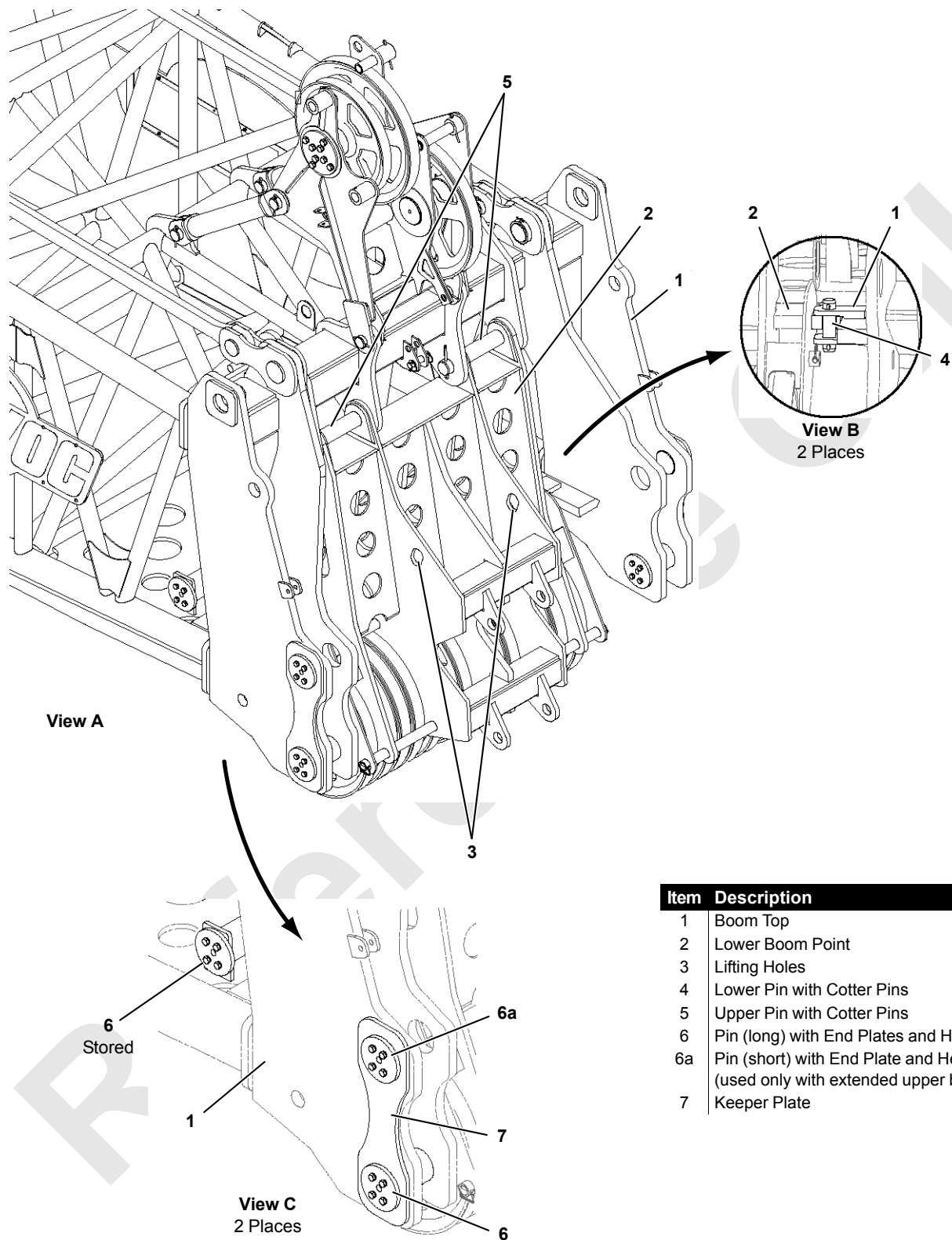


FIGURE 4-26

A11388-4,5,6



Item	Description
1	Boom Top
2	Lower Boom Point
3	Lifting Holes
4	Lower Pin with Cotter Pins
5	Upper Pin with Cotter Pins
6	Pin (long) with End Plates and Hex Screws
6a	Pin (short) with End Plate and Hex Screws (used only with extended upper boom point)
7	Keeper Plate

FIGURE 4-27

## Install Standard Upper Boom Point

Do not install the standard upper boom point if an extended upper boom point or luffing jib will be installed.

See [Figure 4-24](#), View F for the following procedure.

To install the standard upper boom point, use the following:

1. Using nylon lifting slings, lift the upper boom point (15) into position at the lower boom point.
2. Remove the top pin (16) from the holes in the upper boom point.
3. Align the upper holes (A) and install the pin (16).
4. Rest the upper boom point on the ground.
5. Remove the slings.
6. Slowly raise the boom until the bottom holes (B) align.
7. Install the pins (16) in the holes (B).

---

### CAUTION

#### Avoid Upper Boom Point Damage!

Do not rest the weight of the entire boom on the standard upper boom point. Structural damage will occur.

---

## Install Extended Upper Boom Point

Do not install the extended upper boom point if a standard upper boom point or luffing jib will be installed.

See [Figure 4-27](#) for the following procedure:

1. Remove the lower boom point:
  - a. Lower the boom until the sheaves in the lower boom point (2) are clear of the ground.
  - b. Attach the hooks from the assist crane to the lifting holes (3, View A) in the lower boom point (2).
  - c. Remove the lower pins (4, View B).
  - d. Hoist against the lower boom point using the assist crane until the upper pins (5, View A) are loose and remove the upper pins.
  - e. Swing the lower boom point away from the boom top and store it.
  - f. Store the pins (4, 5) in the lower boom point holes.
  - g. Lower the boom top onto blocking at least 305 mm (12 in) high.
2. If installed, remove the pins (6 or 6a, View C) with the end plates and keeper plates (7) from the boom top (1).

This procedure continues on [page 4-55](#).

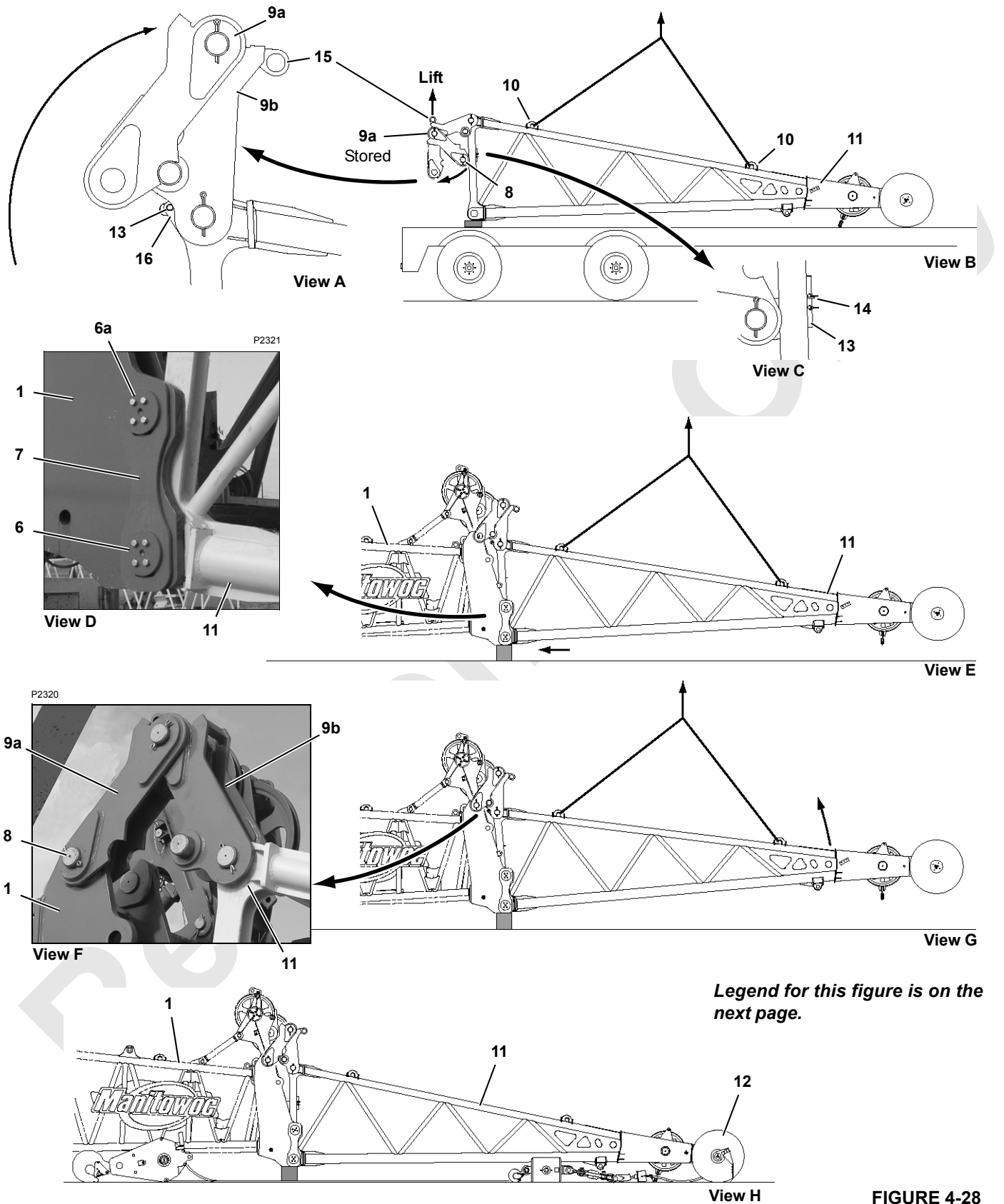


FIGURE 4-28

See [Figure 4-28](#) for the following steps:

3. Remove the pins (8, View B) to disconnect the links (9a) from the storage position and rotate the links (9a) to vertical.
4. Remove the setup pins (13, View C) from the storage lugs (14).
5. Install the links (9a and 9b):
  - a. Attach a lifting sling from the assist crane to the lifting lug (15, View A) on the link (9b).
  - b. Rotate the links (9a and 9b, View A) up until the setup pin (13) can be installed in the setup lug (16).
  - c. Install the setup pin (13).
  - d. Disconnect the lifting sling.
6. Repeat step 5 for the other set of links (9a and 9b).
7. Attach equal length lifting slings from the assist crane to the four lifting lugs (10, View B) on the extended upper boom point (11).
8. Lift the extended upper boom point (11) off the trailer and into position at the boom top (1, View E).
9. If equipped with long top pins (6) in the upper holes, store them with the end plates (View C, [Figure 4-27](#)).
10. Install the bottom pins (6, View D), keeper plates (7), and end plates.
11. Install the short top pins (6a, View D) and outboard end plates.
12. Securely tighten the end plate screws for the pins (6 and 6a).
13. Rotate the extended upper boom point up using the assist crane (View G) to align the connecting holes in the links (9a, View F) with the boom top (1).
14. Install the pins (8).
15. Remove the setup pins (13, View A) from the setup lugs (16) and install the pins in the storage lugs (14, View C).

**NOTE:** Do not perform the next step until the pins (13) are removed to avoid damage.

16. Lower the upper boom point until the rollers (12, View H) are on the ground and disconnect the lifting slings.

As the boom is raised, the extended upper boom point rollers (12) will roll along the ground until the links unfold. The upper point will then lift off the ground as the boom is raised.

**NOTE:** Make sure the roller path is clear of obstructions.



Prior to raising the boom, warn personnel to stand clear of the extended upper boom point rollers.

Legend for [Figure 4-28](#)

Item	Description	Item	Description
1	Boom Top	10	Lifting Lug
6	Pin (long) with End Plates and Hex Screws	11	Extended Upper Boom Point
6a	Pin (short) with End Plate and Hex Screws	12	Roller
7	Keeper Plate	13	Setup Pin with Snap Pins
8	Pin with Cotter Pins	14	Storage Lug
9a	Link	15	Lifting Lug
9b	Link	16	Setup Lug

## Install Load Line

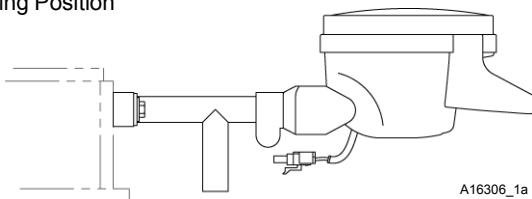
See the Load Block Reeving topic on [page 4-72](#) for proper routing and reeving of load lines.

## Connect Boom Wiring

To connect the boom wiring, use the following:

1. Install the block-up limit components shown in [Figure 4-30](#) and in the Boom Wiring and Limits Electrical drawing at the end of this section.
2. Install the wind speed indicator assembly if removed for shipping. Use star washers to attach the mounting bracket to the boom top to provide ground (see the Wind Speed Assembly drawing at the end of this section).
3. Connect the electric cables from the cable reel in the boom butt to the node controller in the boom butt and to the wireless transceiver in the boom top (see the Boom Wiring and Limits Electrical drawing at the end of this section).
4. Connect the electric cables from the block-up limit switches and wind speed transmitters to the proper receptacles on the boom and jib node controllers.
5. To protect electrical components, use the following:
  - a. Attach sealing caps to the ends of all unused cables, receptacles, and terminator plugs.
  - b. If equipped, attach terminator plugs to unused receptacles.
6. Remove the optional boom light from the shipping position tube by loosening the thumbscrew at the base of the light. Place the light in the working position tube (see [Figure 4-29](#)) and tighten the thumbscrew. Connect the boom light to electrical cable WCLE.

Shipping Position



Working Position

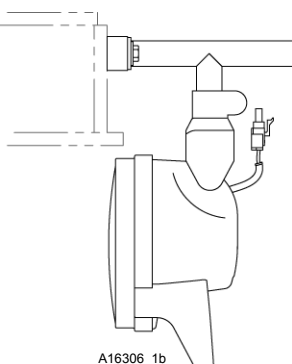


FIGURE 4-29

## Perform Pre-Raising Checks

Perform the following pre-raising checks and correct any defects before raising the boom:

- Crane is on a firm, level surface.
- Boom hinge pins are fully engaged.
- Crawlers blocked if required per Capacity Chart.
- All connecting pins installed and properly retained.
- Boom inserts installed in the proper sequence.
- Boom straps installed in the proper sequence.
- All jib backstay straps, links, and pins removed from boom sections (if luffing jib will not be used).
- All insert and strap connecting pins installed and properly retained.
- Mast arms fully lowered.
- Boom hoist wire rope spooled tightly onto drum and engaged with proper sheaves. Wire rope securely anchored to socket and wedge at mast.
- Load lines spooled tightly onto drums and engaged with proper sheaves. Load lines securely anchored to sockets at boom points or at load block and weight ball.
- All blocking, tools, and other items removed from boom.
- Electronic boom angle indicator properly installed and adjusted.
- Block-up limit control properly installed and operational.
- Rated Capacity Indicator/Limiter properly installed and operational.
- Proper capacity chart selected on configuration screen of RCL display.
- Automatic boom stop properly installed and adjusted after boom is raised.
- Wind is within the allowable limits for the operation as shown in the Wind Conditions document, located at the end of Section 3.
- The boom should now be ready to be raised.

## Boom Removal

Boom removal is the reverse of installation:



### WARNING

#### Tipping Hazard!

Prevent the crane from tipping. Block the ends of the crawlers, if required per the capacity chart, before raising or lowering the boom from or to the ground.



### WARNING

#### Crushing Injury Hazard!

Boom inserts can collapse when connecting pins are removed. Block both ends of each boom insert before removing the connecting pins.

Never work under or inside boom inserts that are not securely blocked.

1. Prepare the crane and boom:
  - a. Position the crane in the disassembly area.
  - b. If required per the capacity chart, travel the front crawler rollers onto blocking at the boom end of the crane).  
  
See the Crawler Blocking Diagram in the Capacity Chart Manual for blocking requirements.
2. Lower the boom to the ground:
  - **If equipped with a fixed or luffing jib**, see the Jib Rigging Guide for procedure.
  - **If equipped with a standard upper boom point**, remove the upper boom point using the reverse assembly steps before it contacts the ground. The upper point cannot support the weight of the boom.
  - **If equipped with an extended upper boom point**, make sure the ground is clear of obstruction so the upper point rollers can roll freely as the boom is lowered.

### CAUTION

#### Pendant Damage!

Use extreme care while lowering the boom equipped with intermediate suspension. Boom straps can land on and crush intermediate suspension pendants.



### WARNING


#### Crushing Injury Hazard!

Do not attempt to unpin straps until they are resting firmly in strap brackets.

3. Continue to lower the boom onto blocking until the boom straps are resting in the brackets on the boom inserts.  
  
***Push intermediate suspension pendants to the inner side of the boom as it is lowered.***
4. Remove and store the intermediate suspension pendants, links and pins. Block under the inserts before removing the lower connecting pins.
5. Store the insert straps and links:

**NOTE:** It is not necessary to remove the boom straps. The straps can be left on the inserts for shipping.

- a. Rotate the links at the front of the butt and inserts forward for storage ([Figure 4-25](#), View B).
- b. Rotate the storage links (4, [Figure 4-25](#), View B) to the shipping position and pin them to secure the links and straps.
6. Remove and store the block-up limit components (see the Boom Wiring and Limits Electrical drawing at the end of this section).
7. Remove and store the wind speed indicator assemblies so they cannot be damaged during shipping (see the Wind Speed Assembly drawing at the end of this section).
8. Disconnect the electric cables from the cable reel in the boom butt at the node controller in the boom butt and at the wireless transceiver in the boom top (see the Boom Wiring and Limits Electrical drawing at the end of this section).
9. Coil the cable onto a cable reel.
10. Disconnect the electric cables between the boom top and upper point or luffing jib.
11. To protect electrical components, use the following:
  - a. Attach sealing caps to the ends of all unused cables, receptacles, and terminator plugs.
  - b. If equipped, attach terminator plugs to unused receptacles.
  - c. Disconnect the optional boom working light from electrical cable WCLE. Loosen the thumbscrew, remove the light from the working position tube and secure the light in the shipping position in the boom butt (see [Figure 4-29](#)).

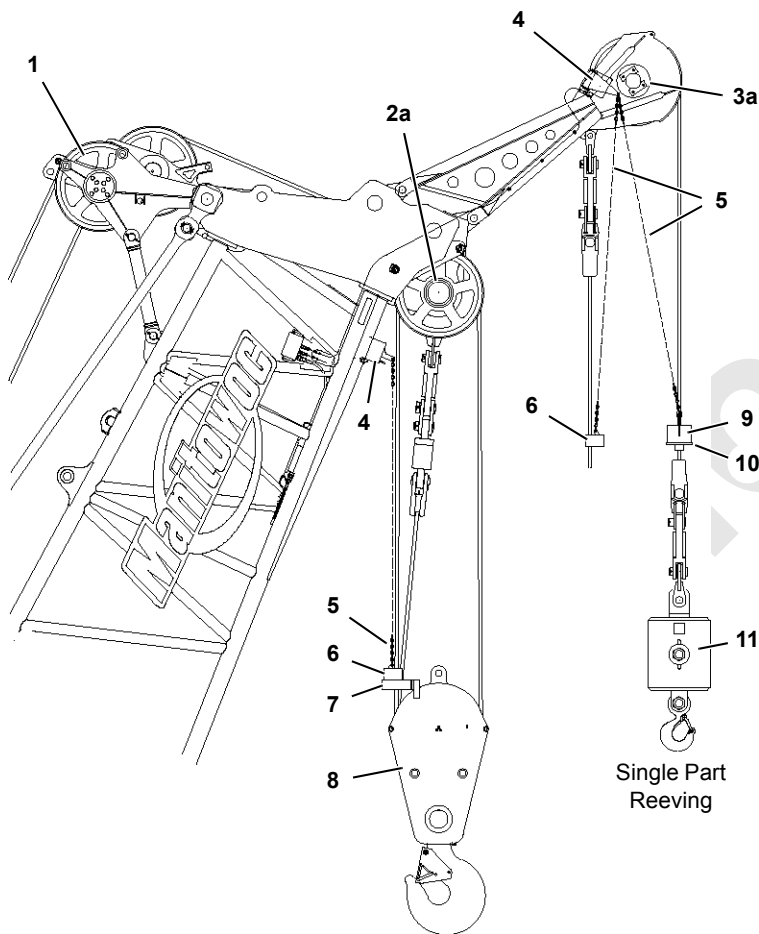
12. Disconnect the load lines from the load block and weight ball and spool the load lines onto the load drums.
  13. Remove the fixed jib or luffing jib if installed.
  14. Remove the extended upper boom point, if installed, using the reverse assembly steps.
  15. Lower the wire rope guide (17, View G) to the shipping position:
    - a. Support the wire rope guide (17).
    - b. Remove the safety pins (19) from the struts (18).
    - c. Rotate the wire rope guide down to the shipping position and install the safety pins (19).
  16. Store the boom top wire rope guide ([Figure 4-24](#), View B):
    - a. Attach a sling to the hole in the wire rope guide (7).
    - b. Support the wire rope guide (7) with the hoist.
    - c. Unpin the struts (10) from the wire rope guide and pin them to the storage lugs (11).
    - d. Lower the wire rope guide (7) to the shipping position.
  - e. Using the pin (9), pin the lug (8) to the upper boom point.
- 
- **WARNING**  
**Pinch Point Hazard!**
- Keep all hands clear of openings in the wire rope guide frame while lowering the wire rope guide in step 17.
- 
17. Store the wire rope guide in the 12 m (40 ft) heavy insert ([Figure 4-24](#), View A):
    - a. Attach a sling to the rope guide pin.
    - b. Support the wire rope guide (2) using the hoist and remove the pin (3) from the operating position.
    - c. Lower the wire rope guide to the shipping position and install the pin (3).
  18. Disassemble the boom sections.
  19. Disconnect the boom butt from the boom. See the Remove Boom Butt topic on page 4-41.
- NOTE:** If shims are used, store the shims on the boom pins.



Reference Only

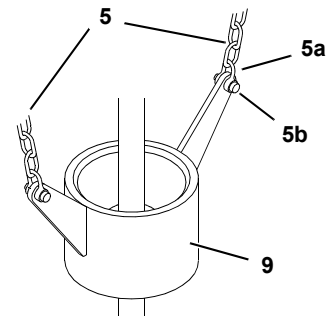
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Item	Description	Item	Description
1	Wire Rope Guide	5b	Pin
2a	Lower Boom Point	6	Weight
2b	Extended Upper Boom Point (lower sheaves)	7	Lift Plate
3a	Standard Upper Boom Point	8	Load Block
3b	Extended Upper Boom Point (upper sheave)	9	Weight
4	Block-Up Limit Switch	10	Lift Block
5	Chain	11	Weight Ball
5a	Shackle		



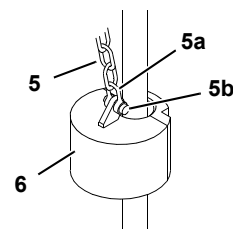
Multiple Part Reeving  
Dead Ended at Boom

Single Part  
Reeving



• Upper Boom Point (1-part)

Dead-End Load Line or  
Slowest Live Line

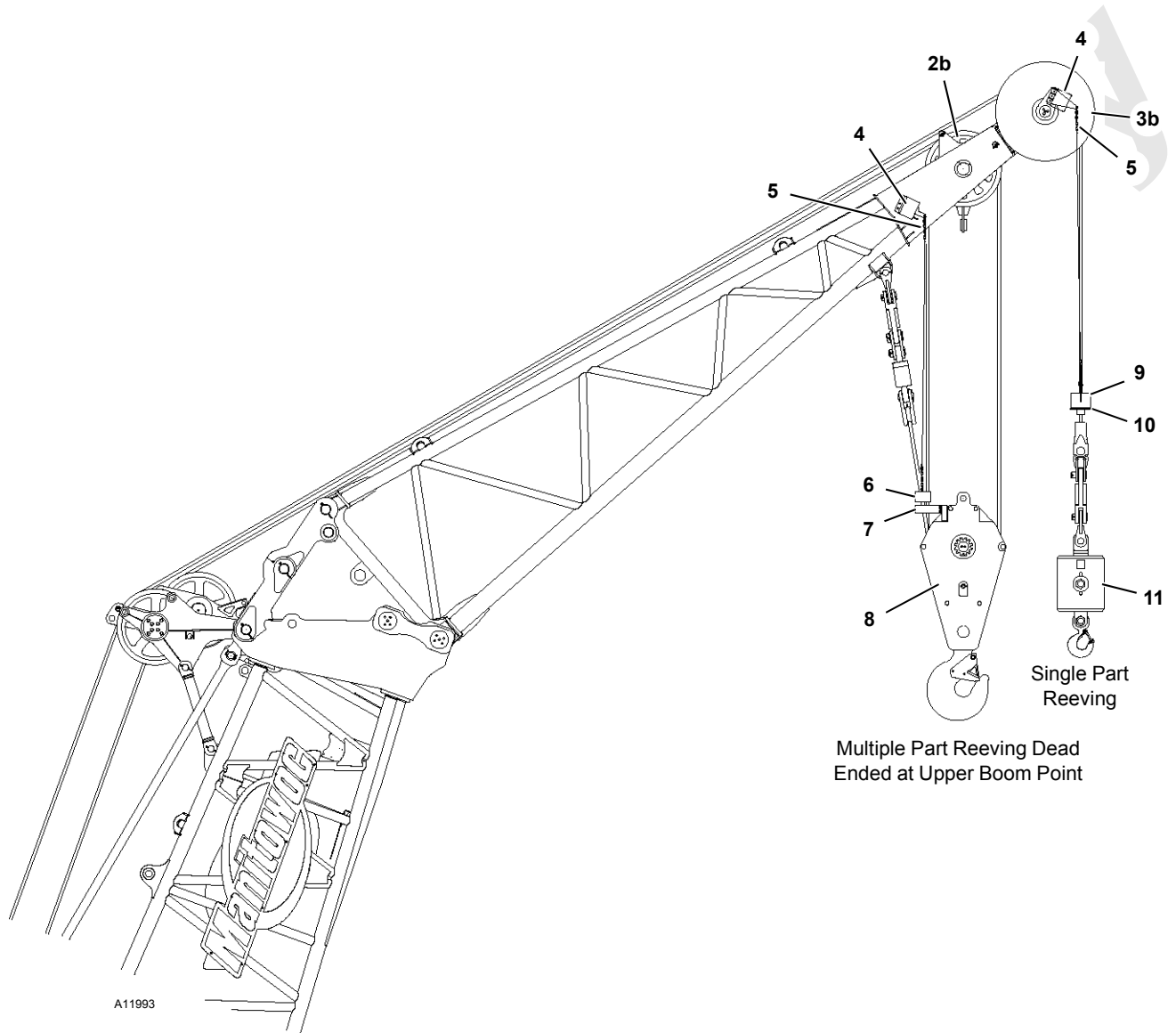


• Lower Boom Point (multiple part)  
• Upper Boom Point (2-part)

Location of Components at Boom Top Shown  
Location of Components at Jib Tops is Similar

See Load Block Reeving Diagrams for  
Suggested Location of Weight with  
Multiple Part Reeving

FIGURE 4-30



Multiple Part Reeving Dead Ended at Upper Boom Point

Single Part Reeving

FIGURE 4-30 continued

## WIRE ROPE INSTALLATION

### Wire Rope Specifications

See the Wire Rope Specifications document 9292-A in the Capacity Chart Manual for the correct type, size, and amount of wire rope to be installed on the crane.

The Wire Rope Specifications document 9292-A contains the following information:

- Parts of the line required for various loads
- Wire rope lengths and notes about hoisting distance for various parts of the line
- Maximum spooling capacity of the load drums

### Wire Rope Storage

**NOTE:** The wire rope manufacturer’s recommendations take precedence over this information.

Store the wire rope in coils or on reels off the ground or floor in a clean and dry indoor location. If outdoor storage is necessary, the wire rope must be covered with a protective wrapper.

Keep the wire rope away from acids, fumes, and other corrosives. Keep the wire rope away from heat that can dry out the lubricant.

If the storage period will be long, lubricate the wire rope and perform periodic inspection given in the Service Manual at least monthly.

### Seizing and Cutting Wire Rope

Apply tight seizings of annealed wire to the ends of all wire rope. If not done, the rope wires and strands may slacken. This action will result in overloading of some strands and underloading of others. Bird caging and breakage of the wire rope can occur.

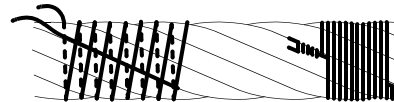
Before cutting wire rope, apply seizings on both sides of the point where the cut will be made. Then cut the wire rope with a torch, rope cutter, or abrasive cut-off wheel.

See [Figure 4-31](#) for the following:

- Number of seizings to be applied to the ends of wire rope and to both sides of the point where a cut will be made
- Proper application method. Each seizing should be one rope diameter long

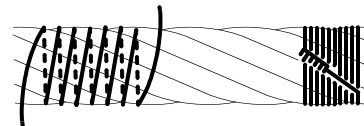
Wire Rope Type	Seizings Required
Preformed	1
Non-preformed	3

Place free end of seizing wire in valley between two strands. Then wind seizing wire over free end as shown. Finally, twist and pull two ends of seizing wire together until seizing is tight.



**View A** - Rope Diameter 26 mm (1 in) and Larger

Wind seizing wire around wire rope as shown. Then twist two ends of seizing wire together at center of seizing. Alternately twist and pull ends until seizing is tight.



**View B** - Rope Diameter Smaller than 26 mm (1 in)

A925

**FIGURE 4-31**

## Anchoring Wire Rope to Drum

See [Figure 4-32](#) for the following procedure.

Use the correct wedge part number for the size of wire rope being used. See the parts drawing for the boom hoist drums or for the load drum shaft to obtain the correct part number:

1. Assemble the wire rope and wedge to the drum socket.
2. Tighten the wedge, rapping the back of the wedge with a brass drift pin and hammer.

The drums are equipped with guards which cover the dead-end sockets on the outside of the drum flanges.



### WARNING

#### Moving Machinery Hazard!

Drum guards shall be secured to the drums during crane operation.

When the guards are removed for wire rope installation, use extreme care to prevent injury from a moving dead-end socket.



### WARNING!

#### Falling Load Hazard!

Wire rope can be pulled out of a drum if the following steps are not taken.

- Install a straight wedge so the corrugated side is against the wire rope.
- Install the wedge so the end of the wire rope extends past the end of the wedge, but not out of the drum socket.
- Make sure seizing is not under the wedge. Remove seizing if it interferes with assembly.

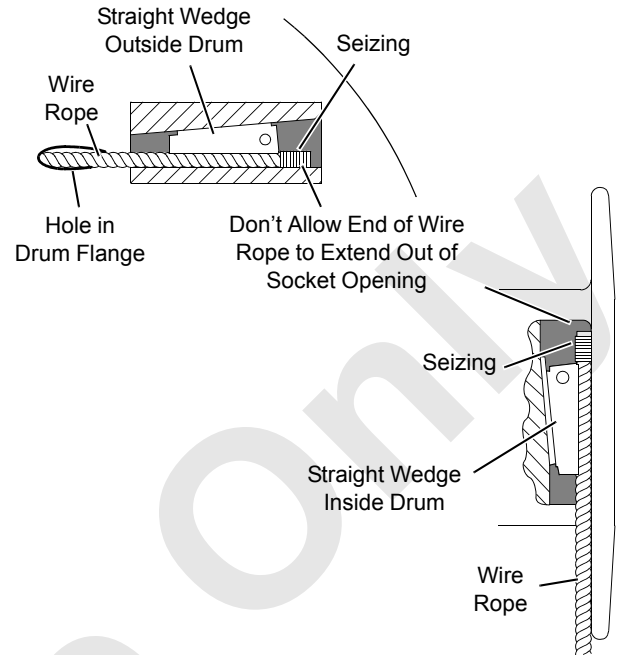


FIGURE 4-32

## Winding Wire Rope Onto a Drum

See the Drum and Lagging Chart 9293-A in the Capacity Chart Manual for the correct size of the drum laggings, if used

### CAUTION!

#### Wire Rope Damage!

The shipping reel must rotate when wire rope is unwound. Attempting to remove wire rope from a stationary reel can result in a kinked wire rope, and the wire rope will be ruined.

**NOTE:** The wire rope manufacturer's recommendations takes precedence over the following information.

1. Remove the wire rope from the shipping reel:
  - a. Mount the wire rope shipping reel on a shaft supported at both ends by jacks or blocks as shown in [Figure 4-33](#).

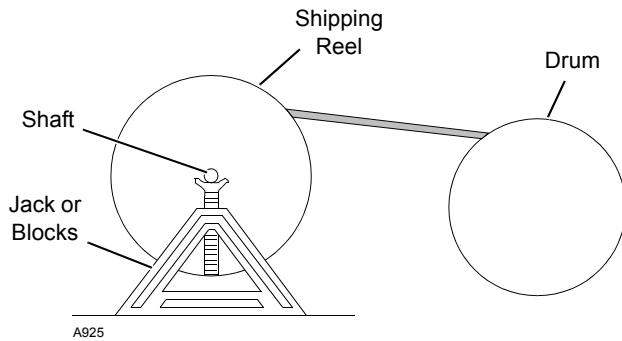


FIGURE 4-33

- b. Provide a brake at the reel (see [Figure 4-34](#)) so the wire rope can be wound tightly onto drum.
  - c. Avoid a reverse bend when winding wire rope onto the drum: wind from the top of reel to the top of drum or from the bottom of the reel to the bottom of the drum as shown in [Figure 4-34](#).
  - d. Avoid dragging wire rope in dirt or around objects that can scrape, nick, cut, or crush the rope.
2. Carefully inspect the drums and all rope guides, rollers, and sheaves for defects that can cause the wire rope to

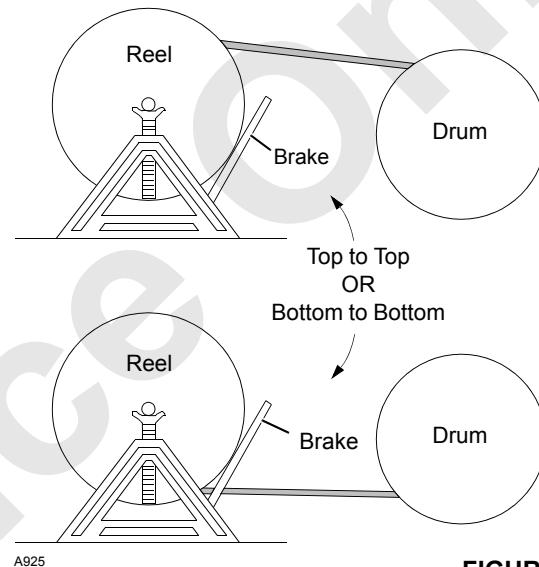


FIGURE 4-34

wear or be cut. If defects cannot be fixed, replace the faulty parts.

### CAUTION!

#### Wire Rope Damage!

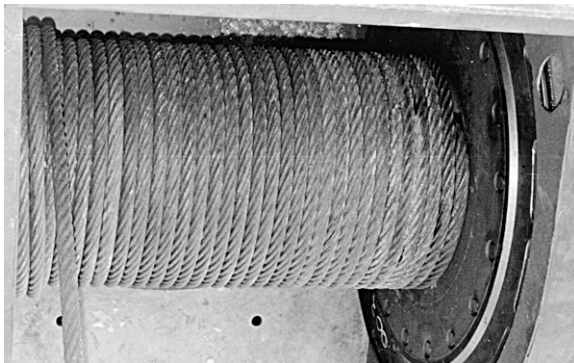
Voids or spaced wraps in the first layer will permit movement and a wedging action with subsequent layers. The wedging action will cause crushing and abrasion of the wire rope.

Never allow wire rope to “cross wind” on drums.

- Apply tension to the wire rope as it is wound slowly onto the drum. Follow the requirements that are in [Figure 4-35](#).

Tap adjacent wraps against each other with a soft metal or wooden mallet.

Use extreme care not to put twists or turns in the wire rope. Allow the rope to assume its natural lay.



M100739

- Wraps of the first layer are tight against the drum and against each other.
- First wrap must be tight against the flange for 3/4 of the drum diameter.

FIGURE 4-35

- See the [Breaking in Wire Rope](#) topic for further instructions.

### Breaking in Wire Rope

After installing a new wire rope, break it in by operating it several times under light load and at reduced speed. This practice allows the wire rope to form its natural lay and the strands to seat properly.

**NOTE:** Wire rope will stretch during the break-in period, reducing the wire rope's diameter as the strands compact around the core.

The dead wraps of wire rope on the drum can become slack during operation, even if the utmost care is used during installation of the wire rope. This slackening is caused by the normal stretch that occurs in a new wire rope under tension and periodically throughout the wire rope's life from release of the load.

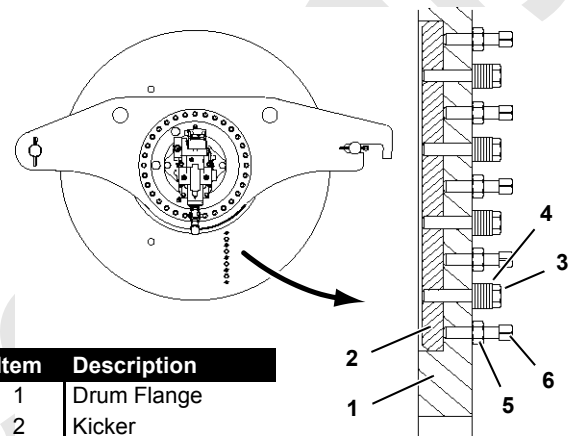
When slackness is noted, tightly wind the dead wraps of wire rope onto the drum. If left uncorrected, a wedging action with

subsequent layers will occur, and the resultant abrasion may cause broken wires in the dead wraps.

### DRUM KICKER ADJUSTMENT

A drum kicker (see [Figure 4-36](#)) is provided on both flanges of the main load drum (in boom butt) to improve wire rope spooling for long boom lengths with small fleet angles where the wire rope might stack up along either drum flange.

Observe the wire rope during initial break-in and periodically during operation. If the rope stacks up at either end of the drum, adjust the drum kickers.



Item	Description
1	Drum Flange
2	Kicker
3	Cap Screw
4	Washers
5	Lock Nut
6	Set Screw

FIGURE 4-36

See [Figure 4-37](#) for following procedure.

To move drum kickers (1) into the drum (take up space), proceed as follows:

1. Remove the drum guard from both ends of the drum.
2. Remove an equal number of washers (3) from both sides of the kicker (1), one side at a time. Each washer allows the kicker to move 2,5 mm (0.098 in).
3. Loosely reinstall the cap screws (2) and remaining washers (3).
4. Loosen the lock nuts (4) and adjust the set screws (5) to move the kickers (1) into the drum.
5. Repeat steps 1 through 4 only enough to improve spooling. **Moving drum kickers in too far can cause premature wire rope wear.**
6. Securely tighten the set screws (5) and lock nuts (4).
7. Reinstall the drum guards.

**TL (Tail Length)**

**Standard 6 to 8 Strand Wire Rope**

Minimum of 6 rope diameters, but not less than 150 mm (6 in).

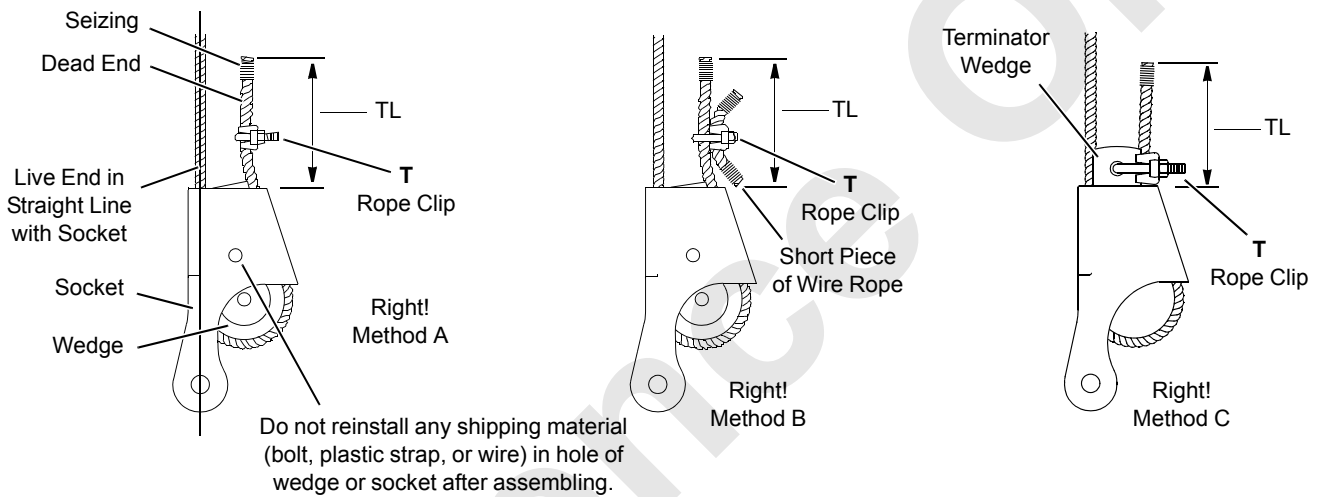
**Rotation Resistant Wire Rope**

Minimum of 20 rope diameters, but not less than 150 mm (6 in).

**T (Rope Clip Nut Torque)**

	Wire Rope/Clip Size			
	mm (inch)	22,23 (7/8)	25,4 (1)	28,58 (1-1/8)
<b>Torque</b>				
kN/m (ft/lbs)	0.30 (225)	0.30 (225)	0.30 (225)	0.49 (360)

Tightening torque values shown are based on threads being clean, dry and free of lubrication.



ALL ARE DANGEROUS AND PROHIBITED!

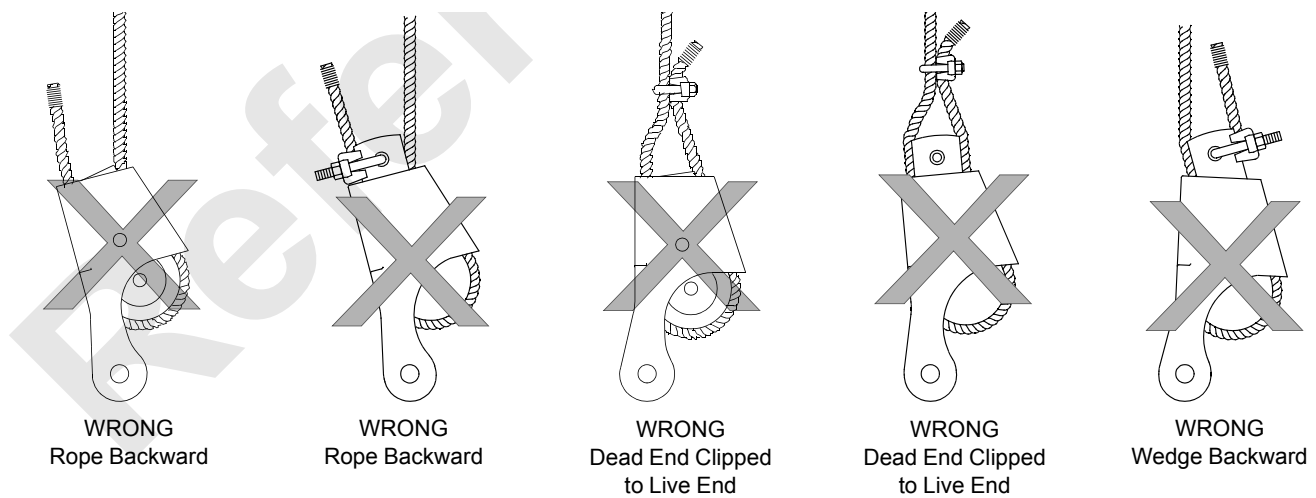


FIGURE 4-37

A925



## Anchoring Wire Rope to Wedge Socket



### WARNING

#### Falling Load Hazard!

To prevent falling loads, use the following precautions:

- Inspect all parts prior to use. Do not use parts that are cracked or otherwise defective.
- Remove minor nicks, burrs, or rough edges from any socket, wedge, or pin by lightly grinding. Do not reduce the original dimensions by more than 10%.
- Do not reinstall shipping material (bolt, plastic strap or wire) in a hole in a wedge or socket after assembly. Discard these materials because they can prevent the wedge from tightening in the socket.
- Only use a wedge and socket that are the correct size for the wire rope being used. Do not mix and match parts from one assembly with parts from another assembly.

The Terminator™ socket and wedge has “go” and “no-go” holes to check for proper rope size.

- Attach a wire rope clip to the dead end of a wire rope after assembling the wire rope to the wedge and socket.
- If the dead end of a wire rope is welded, seize the end of the wire rope and cut off the weld before assembling it to the wedge and socket. The weld will not allow strands of wire rope to adjust around the bend of the wedge, resulting in high strands and wavy rope. This condition can seriously weaken attachment.

See [Figure 4-37](#) for the following procedure:

1. Assemble the wire rope and wedge to the socket so the live end of the wire rope is in a straight line with the socket pin hole. Do not assemble **WRONG** as shown.
2. Allow the dead end of the wire rope to extend past the end of the socket amount shown.
3. Allow the wire rope to assume its natural lay.
4. Pull against the wedge and live end of the wire rope enough to tighten the wedge in the socket.

Use a brass hammer to seat the wedge and wire rope as deep into the socket as possible.

5. Attach a wire rope clip to the dead end of wire rope using one of the **RIGHT** methods shown. The rope clip will aid

in preventing the wire rope from being pulled out of the socket.

**NOTE:** Use Right Method A only if the wire rope clip is small enough to be securely tightened to the dead end. Right Method C is only for a Terminator socket and wedge.

6. After the socket is pinned in place, hoist the load slowly so the wedge seats tight. **Do not shock-load the socket and wedge.**

## Anchoring Wire Rope to Button Socket



### WARNING

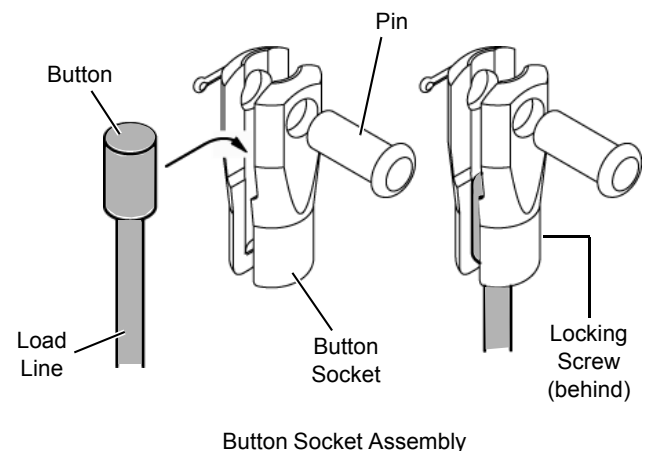
#### Falling Load Hazard!

Wire rope can break if the following precaution is not observed:

- Do not attach the dead end of a wire rope to the live end of a wire rope with a wire rope clip. The wire rope clip will transfer the load from the live side of the wire rope to the dead end, seriously weakening attachment.

See [Figure 4-38](#) for the following procedure:

1. Remove the pin from the socket.
2. Install the button end of the load line in the socket.
3. Pin the socket to the anchor point.
4. Securely tighten the locking screw.



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**FIGURE 4-38**

## Lubricate the Wire Rope

New wire rope is lubricated during manufacturing, but this lubricant is only adequate for initial storage and the early stages of operation. Contact the wire rope manufacturer/dealer for lubrication recommendations. Also, some techniques for safely and efficiently lubricating wire rope can be found in the Lubrication Guide in Section 5.

**Do not use grease to lubricate wire rope.** Grease will not penetrate the rope properly and will buildup in the valleys between wires and strands. This buildup will inhibit rope inspection and could trap moisture in the rope's interior.

## REEVING WITH THE ROPE PAD EYE

See [Figure 4-39](#) for the following procedure.

Some rotation-resistant wire rope supplied by Manitowoc is equipped with a pad eye welded to the leading end of the wire rope or to the button on the end of the wire rope.

A rigging line can be attached to the pad eye to make it easier to reeve the load block.

### Safety

Observe the following precautions:

- Do not exceed the approximate capacities listed in [Figure 4-39](#)
- Make sure the rigging line and attaching hardware (clips and rope connectors) are rated for the approximate capacities shown in [Figure 4-39](#)

- Inspect the pad eye prior to each use. **Replace it if:**
  - Any original dimensions change
  - Cracks or breaks found in any metal weld



### WARNING

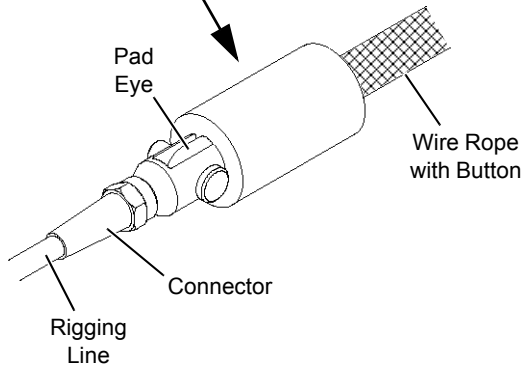
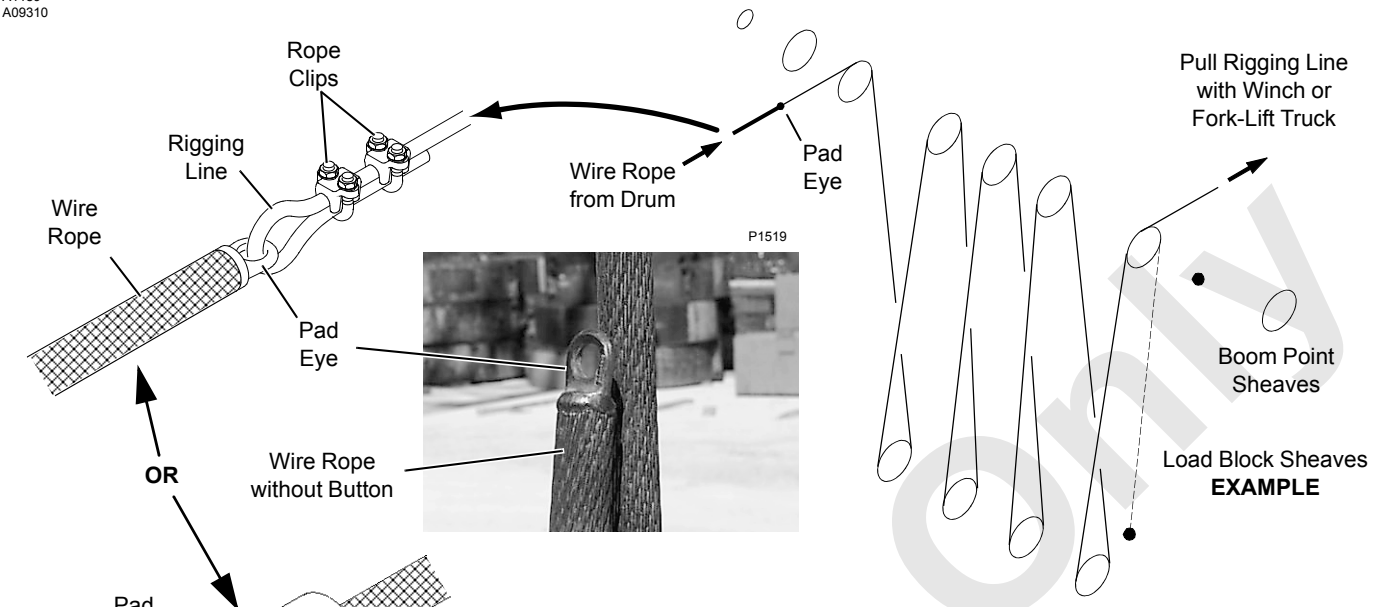
#### Flying Part Hazard!

The pad eye on the end of the wire rope has been provided **for reeving purposes only**. Any other use is neither intended nor approved.

The pad eye can break and fly apart with considerable force if it is overloaded, not used properly, or not maintained properly.

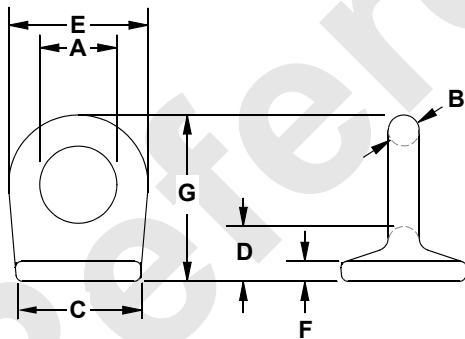
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No. 1.5 Pad Eye			
Approximate Capacity 553 kg (1220 lbs)			
Item	mm	Inch	
A	16,00	5/8	
B	6,35	1/4	
C	25,40	1	
D	11,18	7/16	
E	28,70	1-1/8	
F	4,06	1/16	
G	33,27	1-5/16	

No. 1 Pad Eye			
Approximate Capacity 553 kg (1220 lbs)			
Item	mm	Inch	
A	9,65	3/8	
B	6,35	1/4	
C	22,40	7/8	
D	10,40	13/32	
E	22,40	7/8	
F	3,30	1/8	
G	25,40	1-1/32	



No. 2 Pad Eye			
Approximate Capacity 1.179 kg (2600 lbs)			
Item	mm	Inch	
A	19,05	3/4	
B	9,65	3/8	
C	26,92	1-1/16	
D	12,70	1/2	
E	38,10	1-1/2	
F	4,83	3/16	
G	41,26	1-5/8	

FIGURE 4-39

## RIGGING WINCH OPERATION

If the crane is equipped with the optional rigging winch (Drum 0) see the Rigging Winch Assembly drawing at the end of this section for wire rope routing.

See Figures 4-40 and 4-41 in following procedure.

### Selecting Rigging Winch Mode

To turn on rigging winch mode, use the following:

1. Go to the Function Mode screen in the main display.
2. In level 2, use the select buttons to enter the selected drum screen options. Select the rigging winch data box (Figure 4-40).

**NOTE:** The rigging winch data box will only appear if this feature is available.

3. In level 3, enter the data box and use the select buttons to turn the rigging winch on.
4. The yellow box with the “I” icon appears when the winch is on.

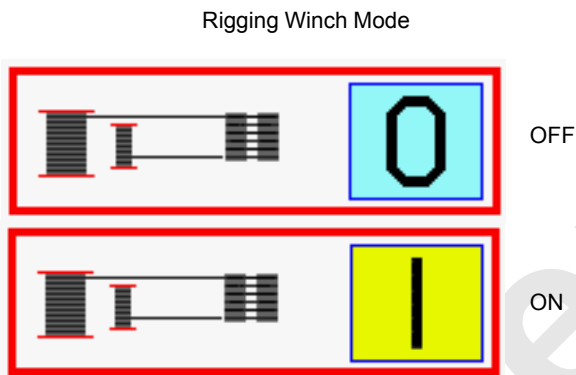


FIGURE 4-40

5. The Drum 4 handle (boom hoist) will now control the rigging winch (Drum 0). A “0” will appear in the indicator at the boom hoist handle.

To turn off rigging winch mode, use the following:

1. Go to the Function Mode screen in the main display.
2. In level 2, use the select buttons to enter the selected drum options screen. Select the rigging winch data box (Figure 4-40).
3. In level 3, enter the data box and use the select buttons to turn off the rigging winch.

**NOTE:** The rigging mode will automatically turn off when power to the control system is turned off.

## Operating Rigging Winch

### Free-Wheel Operation

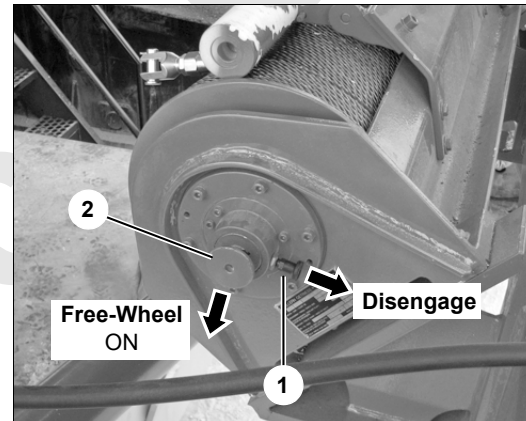
The winch has a free-wheel clutch which allows the drum barrel to be disconnected from the drive mechanism. This position allows the drum to turn by hand.

To turn on free-wheel operation, use the following:

1. Pull out the locking pin (1) and hold it out.
2. Pull out the knob (2).
3. Release the locking pin (1).

To turn off free-wheel operation, use the following:

1. Pull out the locking pin (1) and hold it out.
2. Push the knob (2) in.
3. Release the locking pin (1).



P2314

Item	Description
1	Locking Pin
2	Knob

FIGURE 4-41

### Power Operation

For powered operation, use the following:

1. Engage the free-wheel feature.
2. Turn on the rigging winch mode.
3. Pay out the rigging line by moving the Drum 0 control handle forward.
4. Reeve the rigging line through the block and boom point and connect to the desired load line per the Rigging Winch Assembly drawing at the end of this section.
5. Use the engine throttle to snug up the rigging line prior to paying out the load line from the selected load drum. Slack in rigging line before engaging the automatic part of operation may cause faulty operation.

**NOTE:** Use engine throttle to increase and decrease rigging winch line pull.

6. Use the engine throttle speed to control line slack at the rigging winch.
7. Move the Drum 0 control handle to off and push the corresponding load drum control handle forward to pay out the load line. The rigging winch will haul in the rigging line automatically.

**NOTE:** The stall line pull of the rigging winch is regulated with a proportional relief valve controlled by the crane's programmable controller.

### CAUTION!

#### Avoid Rigging Winch or Wire Rope Damage!

The rigging winch will not automatically pay out line if the selected load drum control handle is pulled back to the hoist position.

**Structural damage to the winch or rigging line will occur!**

If it is necessary to haul in the load line on the load drum when the load line is connected to the rigging line, use the following precautions:

- Pay out the rigging line using the Drum 0 control handle while hauling in the load line using the load drum control handle.
- Keep the rigging line slacker than the load line using the engine throttle.



### WARNING Flying Object Hazard!

Do not attempt to disconnect the rigging line from the load line until the lines are slack.

***The lines could fly apart with explosive force and strike personnel.***

8. Once the load line is reeved through the block and boom point, complete the following:
  - a. Move the load drum control handle to off.
  - b. Pay out the rigging line to slacken the load line by pushing the Drum 0 handle forward.
  - c. Disconnect the rigging line from the load line.
  - d. Haul in the rigging line for storage on the rigging winch by pulling the Drum 0 control handle back.
  - e. Secure the end of the rigging line to the boom for storage.
  - f. Connect the load line to the dead-end socket. See the instructions in this section.
  - g. Turn off the rigging winch mode.

## REEVING – LOAD BLOCK

### Available Load Blocks

See the Boom Assembly drawing at the end of this section for a complete list of load blocks and weight balls available for this crane.



### WARNING

#### Falling Load Hazard!

Use only a load block with a capacity greater than or equal to the load to be handled.

Avoid overloading the load block sheave bearings. Attach the load to a duplex hook so the load hangs straight.

The load block can fail if overloaded, allowing the load to fall.

### Wire Rope Specifications

See the Wire Rope Specifications chart in the Capacity Chart Manual for the following load block reeving information:

- Parts of line required to handle the desired load
- Wire rope length required for various boom lengths and parts of line
- Maximum spooling capacity of load hoists

### Wire Rope Installation

See the [Wire Rope Installation](#) topic for more information on installing wire rope.

### Duplex Hook Usage

Attach the load so it is balanced equally on the hook. Lifting slings must be within the angles in [Figure 4-42](#) to achieve maximum hook capacity. The duplex hook has a hole an optional shackle can be attached to as shown in [Figure 4-42](#).



### WARNING

#### Falling Load Hazard!

Limit the load to be handled with a shackle to the capacity of the load block or shackle, whichever is less.

The load block or shackle can fail if overloaded, allowing the load to fall.

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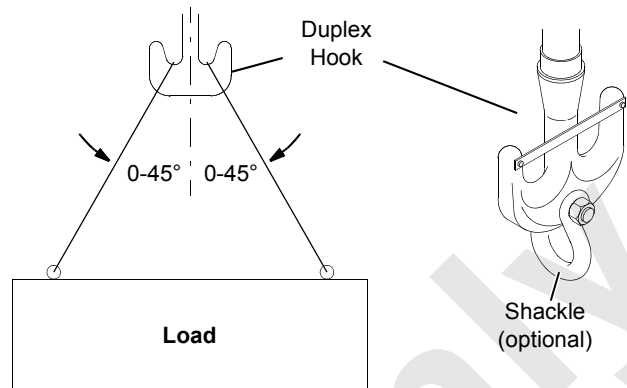


FIGURE 4-42

### Guide Sheaves and Drums

See [Figure 4-43](#) for identification of the load drums and guide sheaves.

Once wire rope is routed through the guide sheaves, be sure to install the rope guard pins, bars, and rollers to retain the wire rope on the sheaves. **Wire rope and sheaves can be damaged if the rope is not properly retained on the sheaves.**

### Load Block Reeving

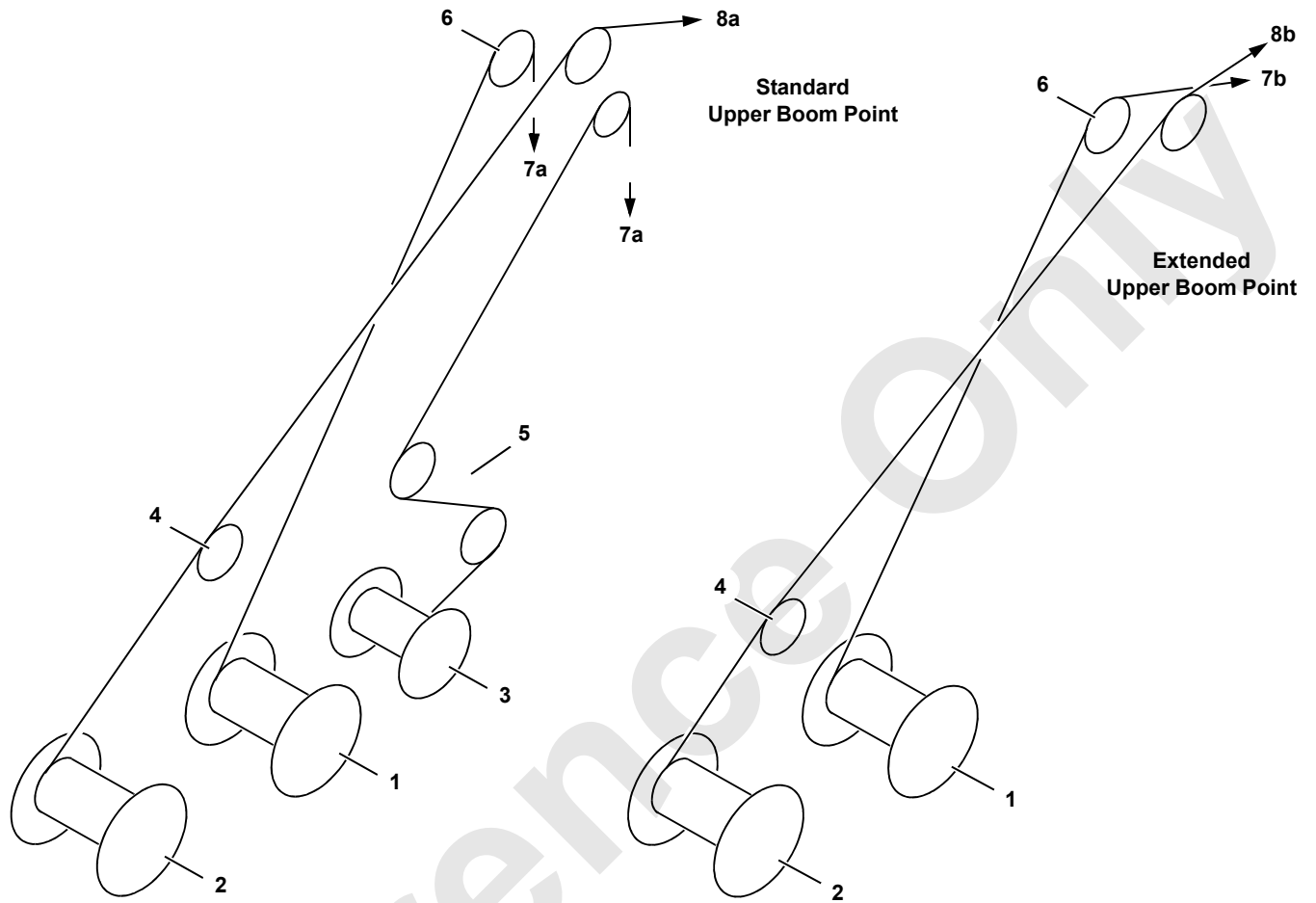
See [Figure 4-44](#) and [Figure 4-45](#) for dead-end locations and components in the lower and upper boom points.

See [Figure 4-46](#) for load block reeving. Reeving the load block in any manner other than those shown can result in excessive block twist.

### CAUTION

#### Wire Rope Damage!

Do not hoist the load block closer to the boom point than shown on the Range Diagram in the Capacity Chart Manual. Improper fleet angle or contact with other parts can damage wire rope.



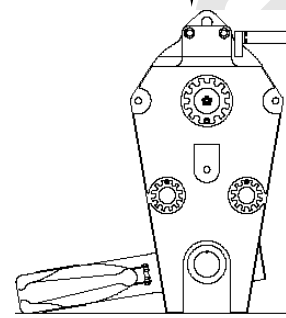
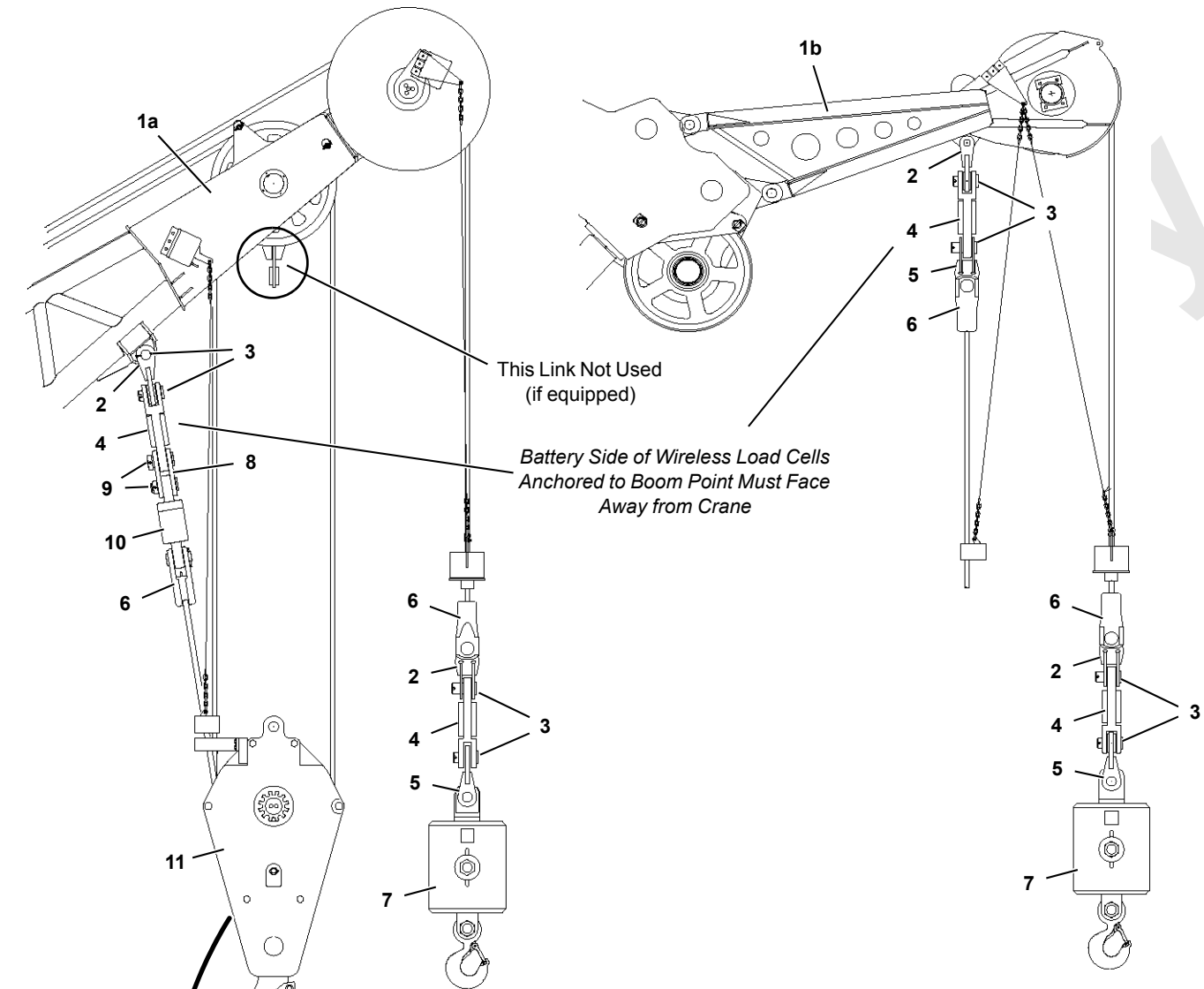
Item	Description
1	Main Hoist (Drum 1 in boom butt)
2	Whip Hoist (Drum 2 in crane)
3	Auxiliary Hoist (Drum 3 in boom butt)
4	Wire Rope Guide (on boom butt)
5	Wire Rope Guides (in insert)
6	Wire Rope Guide (on boom top)
7a	To Lower Boom Point
7b	To Extended Upper Boom Point (lower sheaves)
8a	To Standard Upper Boom Point
8b	To Extended Upper Boom Point (upper sheave)

**NOTE:** See Wire Rope Specifications Chart for line pull of drums. Drums 2 and 3 do not have same line pull as Drum 1.

Drum 2 has a high-speed option. This option does not increase line pull-only speed. High-speed is approximately 80% faster than standard speed (depending on load and layer).

FIGURE 4-43

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**! WARNING**

**Avoid Death or Serious Injury!**

Exercise care when the block is standing in the vertical position, as the potential for tipping exists. Potential causes of tipping are an unstable work area, boom movement and the reeving process.

If the work area is unstable, lay the block flat on the side plate.

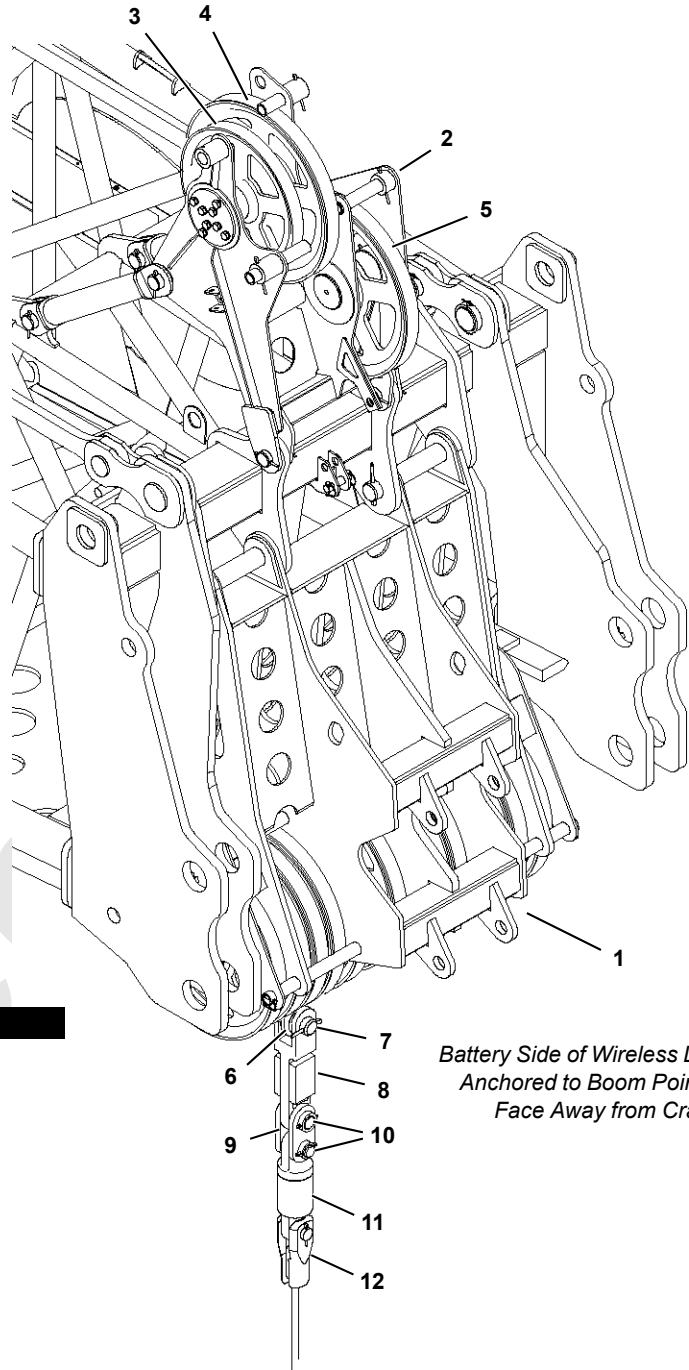
Item	Description
1a	Extended Upper Boom Point
1b	Standard Upper Boom Point
2	Link with Pin with Cotter Pin
3	Pin with Cotter Pin
4	Load Cell—15 876 kg (35,000 lb)
5	Link
6	Button Socket—28 mm (1-1/8 in) with Pin and Cotter Pin
7	Weight Ball
8	Links
9	Pin with Collar, Retaining Pin, and Cotter Pins
10	Swivel
11	Load Block

Figure 4-44





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**Item Description**

- 1 Lower Boom Point
- 2 Wire Rope Guide (on boom top)
- 3 Luffing Hoist Guide Sheave
- 4 Whip Hoist Guide Sheave
- 5 Main Hoist Guide Sheave
- 6 Dead-End Link
- 7 Pin with Cotter Pin
- 8 Load Cell—15 876 kg (35,000 lb)
- 9 Links
- 10 Pin with Collar, Retaining Pin, and Cotter Pins
- 11 Swivel
- 12 Button Socket—28 mm (1-1/8 in) with Pin and Cotter Pin

*Battery Side of Wireless Load Cell  
Anchored to Boom Point Must  
Face Away from Crane*

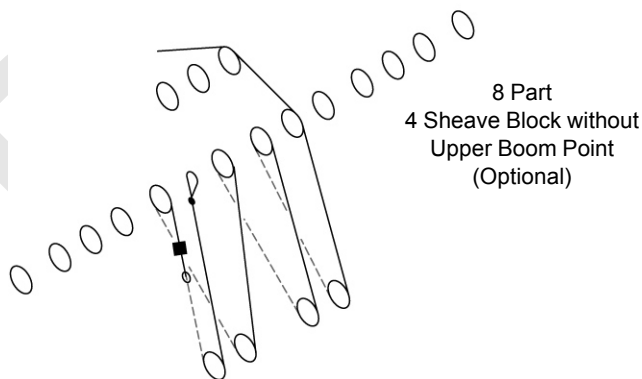
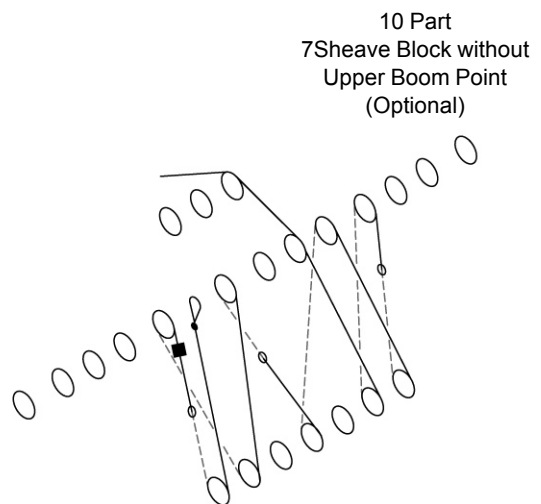
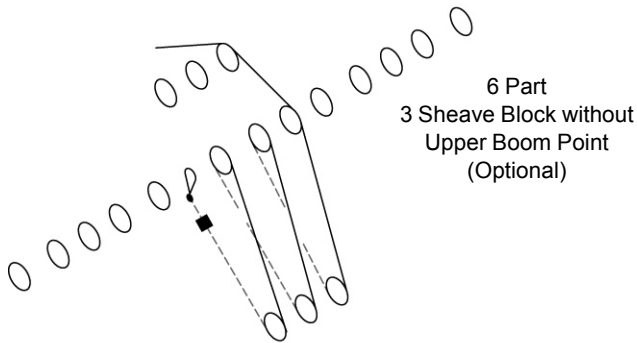
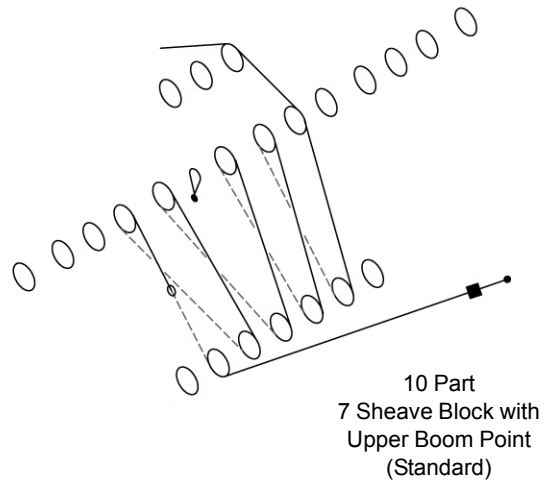
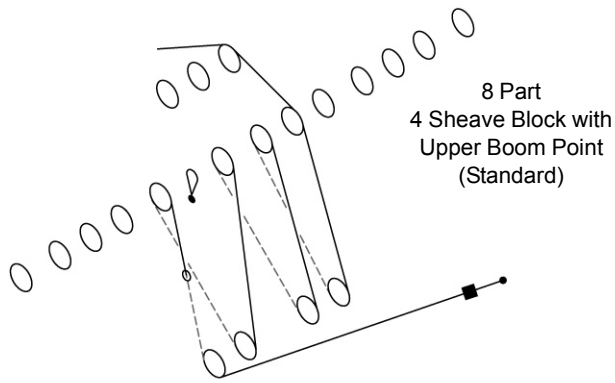
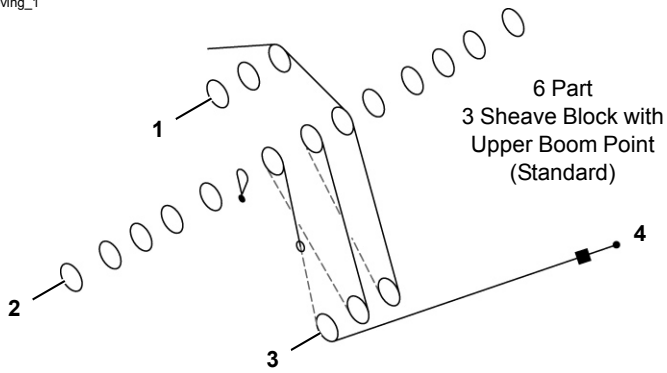
**4**

**FIGURE 4-45**

Reeving\_1

**LOWER BOOM POINT REEVING**

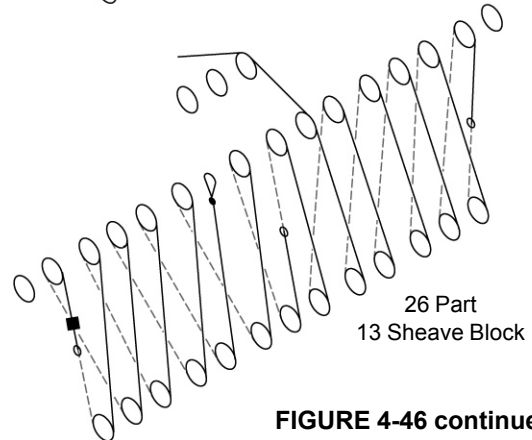
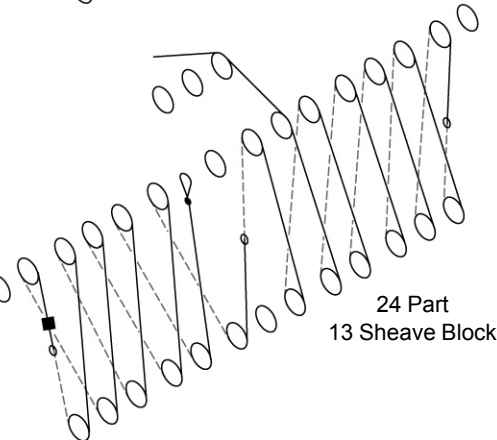
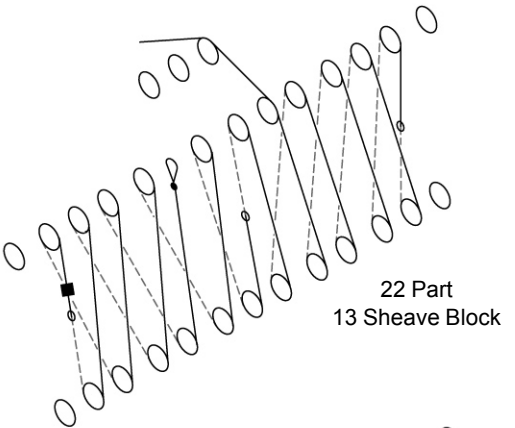
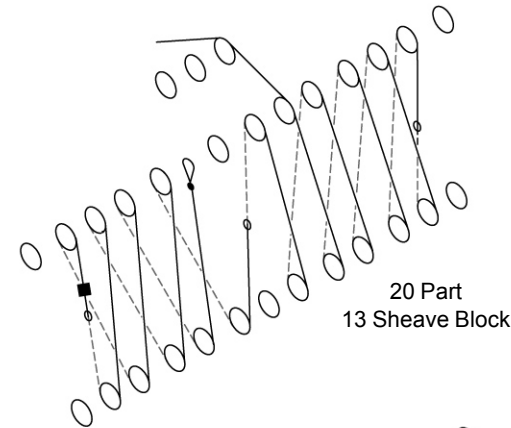
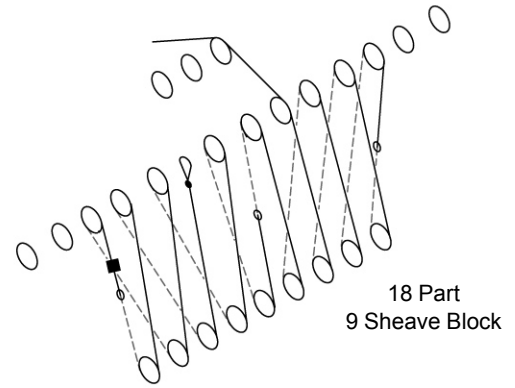
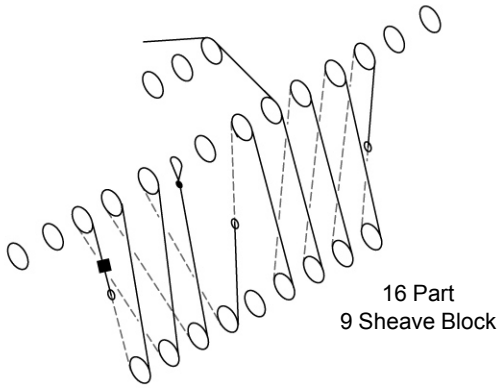
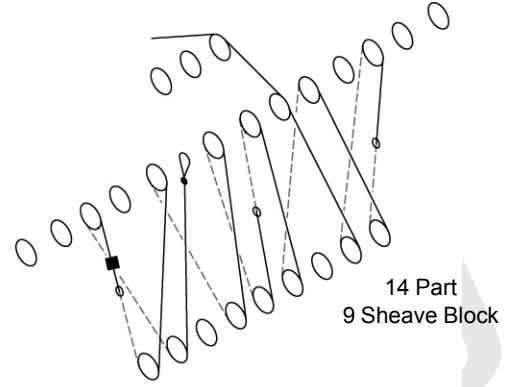
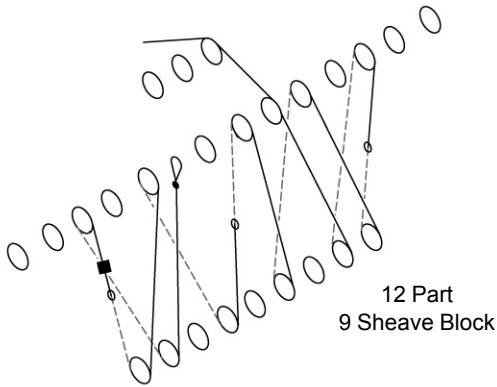
Item	Description
1	Boom Top Guide Sheaves
2	Lower Boom Point
3	Load Block
4	Standard Upper Boom Point
●	Dead-End Socket
■	Two-Block Weight



**FIGURE 4-46**

Reeving\_2

**LOWER BOOM  
POINT REEVING**

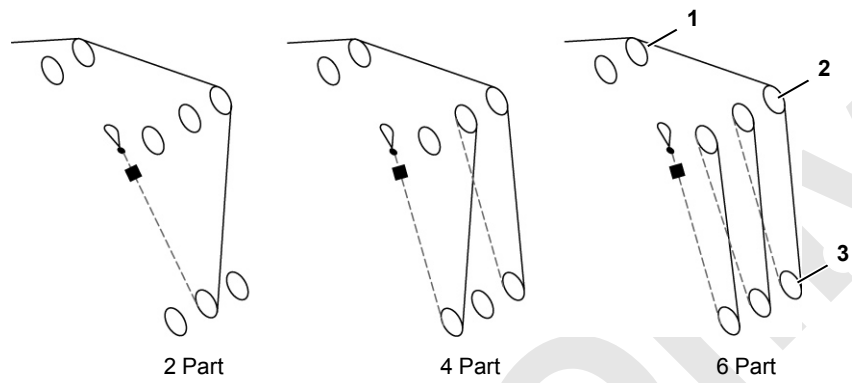


**FIGURE 4-46 continued**

Reeving\_3

Item	Description
1	Boom Top Guide Sheaves
2	Extended Upper Boom Point (lower sheaves)
3	Load Block
●	Dead-End Socket
■	Two-Block Weight

**EXTENDED BOOM POINT REEVING  
(Lower Sheaves)**



**FIGURE 4-47**

### REEVING – LIVE MAST

The live mast wire rope shall be reeved between drum 4 and the mast hoist sheaves as shown in [Figure 4-48](#).

Use **Manitowoc #15836 wedge** for anchoring the wire rope to the drum sockets.

### Wire Rope Specification

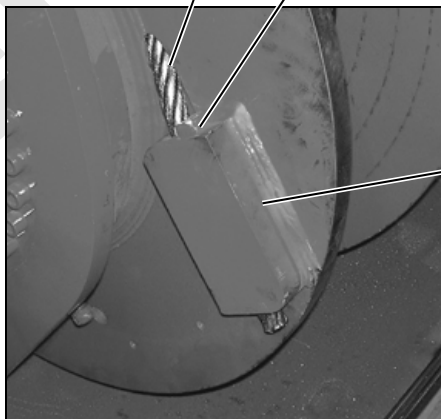
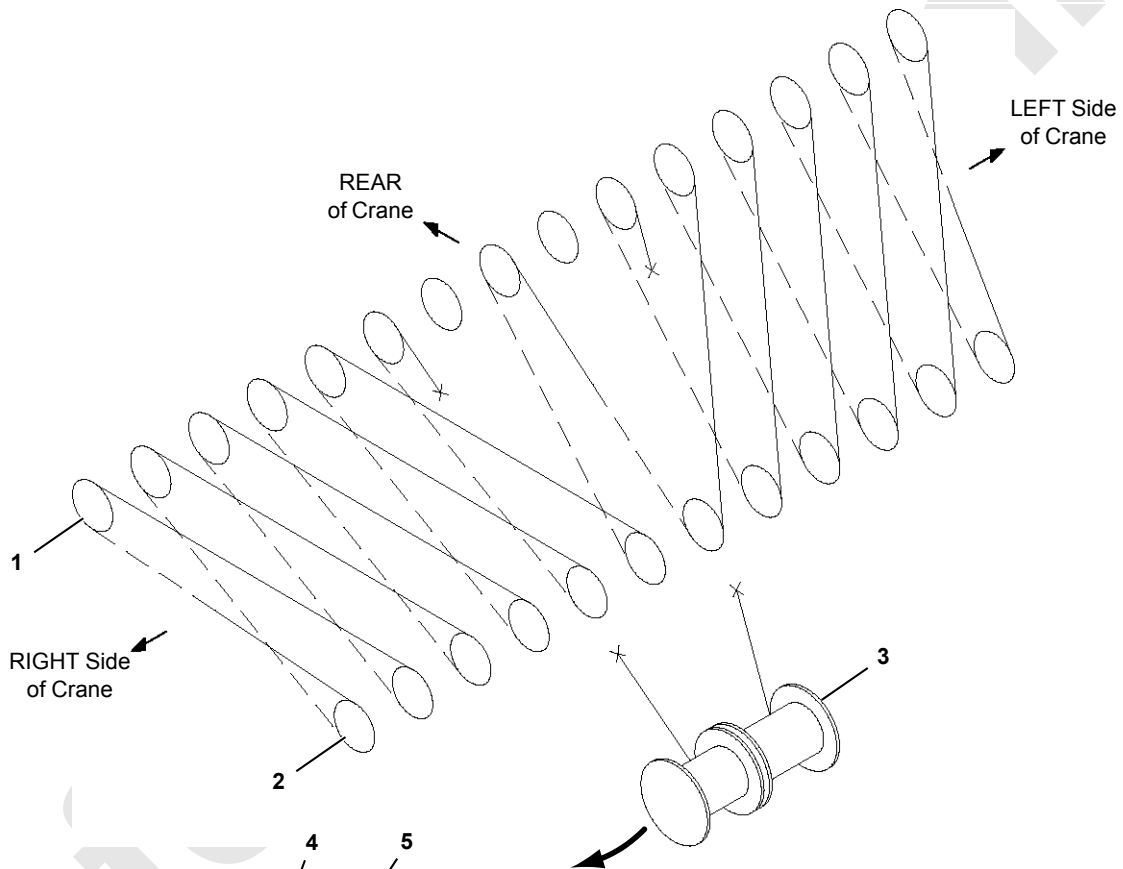
Manitowoc recommends the following wire rope for the live mast:

**Manitowoc #A05680**

Length—494 m (1,620 ft)  
 Diameter—28 mm (1-1/8 in)  
 Minimum Breaking Strength—707 kN (159,000 lb)  
 Rope diameter at no load:

- 29,46 mm (1.160 in) maximum
- 28,85 mm (1.136 in) minimum

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Item	Description
1	Sheave Cluster at End of Mast
2	Sheave Cluster at Rear of Rotating Bed
3	Boom Hoist (Drum 4)
4	Wire Rope
5	Wedge, 28 mm (1-1/8 in)
6	Drum Socket

FIGURE 4-48

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## SECTION 5 LUBRICATION

### LUBRICATION

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## SECTION 6 MAINTENANCE CHECKLIST

### INSPECTION AND MAINTENANCE CHECKLIST

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### FIBERGLASS MAINTENANCE

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